STIC Search Report
EIC 1700

USPTO

STIC Database Tracking Number: 115082

TO: Raymond Alejandro
Location: REM 6B59
Art Unit : 1745
March 1, 2004

Case Serial Number: 10/019903

From: Michael Newell
Location: EIC 1700
REMSEN 4A30
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Search Notes

See applicants' disclosure (PCT) on page 61.

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Search and Information Resources Administration

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SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: Raymond Alejandro Examiner # : 76895 Date: 02/24/04
Art Unit: 1745 Phone Number 30(571)272-1282 Serial Number: 10/019903
Mail Box and Bldg/Room Location: Remsen 6B59 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

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Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Process for Regeneration of Reforming Catalyst

Inventors (please provide full names): Burch et al

Earliest Priority Filing Date: 05/13/02

***For Sequence Searches Only* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.**

Please, refer to attached claims 1-8 for subject matter to be searched for.

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STAFF USE ONLY	**Type of Search**	**Vendors and cost where applicable**
Searcher: Mike Newell	NA Sequence (#) ______	STN 387.98
Searcher Phone #: 571-272-2538	AA Sequence (#) ______	Dialog ______
Searcher Location: Remsen 4A30	Structure (#) ______	Questel/Orbit ______
Date Searcher Picked Up: 3/1/04	Bibliographic ✓	Dr.Link ______
Date Completed: 3/1/04	Litigation ______	Lexis/Nexis ______
Searcher Prep & Review Time: 70	Fulltext ______	Sequence Systems ______
Clerical Prep Time: ______	Patent Family ______	WWW/Internet ______
Online Time: 60	Other ______	Other (specify) ______

PTO-1590 (8-01)

Amendments to the Claims: This listing of claims will replace all prior versions, and listings, of claims in the application

Listing of Claims:

1. (Currently Amended) A method for regenerating a catalytic fuel processor, wherein one component of the processor is a bed of reforming catalyst that reforms fuel thereby producing reformate having a concentration of hydrogen, while ~~it~~ the processor is being used to supply hydrogen to a fuel cell, comprising any one or more of the steps of:

- continuing to pass fuel, air and steam through ~~a~~ the bed of reforming catalyst to produce reformate ~~whilst the catalyst is~~and heating the bed of reforming catalyst ~~heated~~ by an external heat source such that the temperature of the catalyst may be adjusted to regenerate the bed of reforming catalyst,

- continuing to pass fuel, air and steam through ~~a~~ the bed of reforming catalyst to produce reformate and modulating the air and/or steam feed rate supplied to the bed of reforming catalyst to regenerate the bed of reforming catalyst,

- continuing to pass air, fuel and steam through ~~a~~ the bed of reforming catalyst to produce reformate and modulating the feed-rate of the fuel supplied to the bed of reforming catalyst to regenerate the bed of reforming catalyst,

- continuing to pass fuel, air and steam through ~~a~~ the bed of reforming catalyst to produce reformate and adding ~~wherein~~ an oxygenate ~~is added~~ to the feed supplied to the bed of reforming catalyst to regenerate the bed of reforming catalyst,

and maintaining the hydrogen concentration (as measured in dry reformate) above 25% throughout the operation of the processor, wherein the hydrogen concentration is measured by gas chromatography after the reformate is passed through a drier.

2. (Currently Amended) A method for preventing or retarding the de-activation of a catalytic fuel processor wherein one component of the processor is a bed of reforming catalyst that reforms fuel thereby producing reformate having a concentration of hydrogen, while ~~it~~ the processor is being used to supply hydrogen to a fuel cell comprising any one or more of the steps of:

- continuing to pass fuel, air and steam through ~~a~~ the bed of reforming catalyst to produce reformate ~~whilst the catalyst is~~and heating the bed of reforming catalyst ~~heated~~ by an external heat source such that the temperature of the catalyst may be adjusted to regenerate the bed of reforming catalyst,

- continuing to pass fuel, air and steam through ~~a~~ the bed of reforming catalyst to produce reformate and modulating the air and/or steam feed rate supplied to the bed of reforming catalyst to regenerate the bed of reforming catalyst,

- ~~continuing to pass air, fuel and steam through a the bed of reforming catalyst to~~ produce reformate and modulating the feed-rate of the fuel supplied to the bed of reforming catalyst to regenerate the bed of reforming catalyst,

- continuing to pass fuel, air and steam through ~~a~~ the bed of reforming catalyst to produce reformate and adding ~~wherein~~ an oxygenate ~~is added~~ to the feed supplied to the bed of reforming catalyst to regenerate the bed of reforming catalyst,

and maintaining the hydrogen concentration (as measured in dry reformate) above 25% throughout the operation of the processor, wherein the hydrogen concentration is measured by gas chromatography after the reformate is passed through a drier.

3. (Previously Presented) A method according to either claim 1 or claim 2, whereby water is temporarily added to the fuel.

4. (Previously Presented) A method according to claims 1 or 2 in which air is temporarily added to the feed.

5. (Previously Presented) A method according to claims 1 or 2 in which an oxygenate is added to the feed.

6. (Previously Presented) A method according to claim 5 in which the oxygenate is MTBE (methyl-tert-butylether).

7. (Currently Amended) A method according to claims 1 or 2 in which the ~~catalyst bed~~ temperature of the bed of reforming catalyst is raised temporarily by an external heat source.

8. (Currently Amended) A method according to claims 1 or 2 in which the temperature of ~~one or more of the reactant feeds~~ the fuel, air or steam is raised temporarily.

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=> d his

     (FILE 'HOME' ENTERED AT 11:33:18 ON 01 MAR 2004)

     FILE 'HCAPLUS' ENTERED AT 11:33:28 ON 01 MAR 2004
L1     1165352 S CATALYST? OR CATALYSIS OR CATALYZ? OR CATALYTIC
L2     1108627 S REGENERAT? OR GENERAT? OR RECYCL? OR REFORM?
L3       33196 S L1 (3A) L2
L4        5504 S (REFORMING(W)CATALYSTS)/IT

     FILE 'REGISTRY' ENTERED AT 11:36:28 ON 01 MAR 2004
                 E MTBE/CN
L5           1 S E3
                 E HYDROGEN/CN
L6           1 S E3

     FILE 'HCAPLUS' ENTERED AT 11:37:13 ON 01 MAR 2004
L7        6628 S MTBE OR (METHYL(W)TERT(W)BUTYL(W)ETHER) OR L5
L8      398351 S (HYDROGEN(3A)(GAS OR GASES OR GASEOUS)) OR H2 OR L6
L9           5 S L3 AND L7 AND L8
L10      70527 S C01B/IPC
L11       2342 S L10 AND L3
L12        810 S L10 AND L4
L13      42502 S FUEL(2A)(CELL OR CELLS)
L14        723 S L1 (3A) L2 (4A)L13
L15        280 S L14 AND L10
L16          0 S L15 AND L7
L17        270 S (FUEL (4A) STEAM (4A) AIR)
L18          4 S L14 AND L17
L19          9 S L9 OR L18
L20         21 S L17 AND 49/SC,SX
L21         28 S L19 OR L20
L22         60 S L17 AND L13
L23         46 S L22 NOT L21
L24         74 S L21 OR L22
L25         64 S L24 AND ((1907-2001)/PY OR (1907-2001)/PRY)
L26         59 S L25 NOT L9

     FILE 'WPIX' ENTERED AT 11:52:34 ON 01 MAR 2004
L27        222 S L14
L28        119 S L27 AND L10
L29          2 S L28 AND L17
L30          8 S L28 AND (BED OR BEDS)
L31          9 S L29 OR L30
L32          0 S L28 AND L7
L33         67 S L28 AND (HEAT OR HEATS OR HEATING)
L34        110 S L28 AND L2/TI
L35         64 S L33 AND L34
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L36 21 S L35 AND STEAM
L37 26 S L36 OR L31

FILE 'JAPIO' ENTERED AT 12:05:59 ON 01 MAR 2004
L38 72 S L14
L39 15 S L38 AND STEAM

FILE 'HCAPLUS, WPIX, JAPIO' ENTERED AT 12:09:03 ON 01 MAR 2004

=> d l26 1-59 cbib abs hitstr hitind

L26 ANSWER 1 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2003:260901 Document No. 138:274098 Method of delivering fuel and air to a **fuel cell** system. Gittleman, Craig S. (General Motors Corp., USA). U.S. Pat. Appl. Publ. US 2003064259 A1 20030403, 8 pp. (English). CODEN: USXXCO. APPLICATION: US 2001-967278 20011001.

AB A method for removing sulfur-contg. species from a liq. hydrocarbon fuel and capturing a portion of vaporized sulfur-free fuel to be processed into hydrogen for use in a **fuel cell** engine. Sulfur is removed from a hydrocarbon fuel such as gasoline, diesel, or kerosene by heating the fuel under pressure so to keep the fuel in the liq. phase, and passing it over a sulfur trap that contains an adsorbent bed that adsorbs the sulfur-contg. species in the fuel. The sulfur-free fuel that exits the adsorbent bed is slightly depressurized to generate a two-phase hydrocarbon mixt. The vapor/liq. mixt. is sepd., and the liq. portion is sent to the inlet of a fuel processor system where it is mixed with air and steam to produce a hydrogen-rich reformate mixt. The vapor portion of the sulfur-free hydrocarbon mixt. is sent to a vapor canister where it is adsorbed on an activated carbon adsorbent. The adsorbed hydrocarbon vapors are desorbed from the vapor trap by purging it with air when the **fuel cell** engine is first started up. The mixt. of air and sulfur-free hydrocarbon fuel is sent to a thermal start device or to the fuel processing system to be used to rapidly start the **fuel cell** engine using sulfur-free fuel before the liq.-phase sulfur trap has reached an operating temp. sufficient to remove sulfur components from the liq. fuel.

IC ICM H01M008-04
ICS H01M008-06

NCL 429017000; 429024000

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 51

ST **fuel cell** system **fuel** air delivery

IT Hydrocarbons, uses
(liq.; method of delivering fuel and air to **fuel cell** system)

IT Adsorbents
Diesel fuel
Fuel cells
Oxidation catalysts
Poisoning, catalytic
Reforming catalysts
Water gas shift reaction catalysts
(method of delivering fuel and air to **fuel cell** system)
IT Gasoline
Kerosene
(method of delivering fuel and air to **fuel cell** system)
IT Disulfides
Sulfides, processes
Thiols (organic), processes
(method of delivering fuel and air to **fuel cell** system)
IT Oxidation
(partial, reactor; method of delivering fuel and air to **fuel cell** system)
IT Fuel gas manufacturing
(**steam** reforming; method of delivering **fuel** and **air** to **fuel cell** system)
IT 7440-44-0, Activated carbon, uses
(activated, adsorbent; method of delivering fuel and air to **fuel cell** system)
IT 1313-99-1, Nickel oxide, uses 1314-13-2, Zinc oxide, uses 1344-70-3, Copper oxide 7439-98-7, Molybdenum, uses 7440-02-0, Nickel, uses 7440-48-4, Cobalt, uses 7440-50-8, Copper, uses 7440-66-6, Zinc, uses 11098-99-0, Molybdenum oxide 11104-61-3, Cobalt oxide
(adsorbent; method of delivering fuel and air to **fuel cell** system)
IT 95-15-8, Benzothiophene 110-01-0, Tetrahydrothiophene 110-02-1, Thiophene 7704-34-9, Sulfur, processes 7704-34-9D, Sulfur, compds.
(method of delivering fuel and air to **fuel cell** system)
IT 1333-74-0P, Hydrogen, uses
(method of delivering fuel and air to **fuel cell** system)

L26 ANSWER 2 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2003:240265 Document No. 138:257900 **Fuel cell** power generation system using steam and air in stead of nitrogen for shutdown. Kahara, Toshiki; Okusawa, Tsutomu; Minakami, Takaaki; Takahashi, Kokoro (Hitachi Ltd., Japan). Jpn. Kokai Tokkyo Koho JP

2003092126 A2 20030328, 5 pp. (Japanese). CODEN: JKXXAF.
APPLICATION: JP 2001-282880 20010918.

AB The system is constituted by a steam reformer for converting hydrocarbon fuels to H2 and CO, a water-gas-shift reactor for allowing CO to react with steam to give H2 and CO2, a selective oxidizing app. for oxidizing CO discharged from the shift reactor, a **fuel cell**, and a line for bypassing hydrogen around the fuel gas; wherein shutdown of the system is carried out by (1) stopping the supply of fuels and air to the reformer, (2) supplying steam to the system for lowering the temp. of all app., and (3) supplying air to the system for removing steam. Since the system does not use inert gas (e.g., N) for the shutdown, it can be small sized.

IC ICM H01M008-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** shutdown supply **steam**
air

IT Oxidation
Water gas shift reaction
(app.; in **fuel cell** power generation system using steam and air in stead of nitrogen for shutdown)

IT **Fuel cells**
Steam
Water vapor
(**fuel cell** power generation system using steam and air in stead of nitrogen for shutdown)

IT Hydrocarbons, processes
(steam reforming of; **fuel cell** power generation system using steam and air in stead of nitrogen for shutdown)

IT Reforming apparatus
(steam; in **fuel cell** power generation system using steam and air in stead of nitrogen for shutdown)

IT Air
(supplying of; **fuel cell** power generation system using steam and air in stead of nitrogen for shutdown)

IT 630-08-0, Carbon monoxide, processes
(formation and oxidn. of; **fuel cell** power generation system using steam and air in stead of nitrogen for shutdown)

IT 124-38-9, Carbon dioxide, formation (nonpreparative)
(formation of; in **fuel cell** power generation system using steam and air in stead of nitrogen for shutdown)

IT 1333-74-0P, Hydrogen, preparation
(manuf.; **fuel cell** power generation system using steam and air in stead of nitrogen for shutdown)

IT 7732-18-5, Water, uses
(vapor; **fuel cell** power generation system

using steam and air in stead of nitrogen for shutdown)

L26 ANSWER 3 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2003:36341 Document No. 138:109124 Fuel reforming system to produce hydrogen-rich gas for **fuel cells**. Tabata, Takeshi; Echigo, Mitsuaki; Kamiya, Norihisa; Takami, Susumu; Higashiguchi, Seisaku; Hirai, Kazuhiro (Osaka Gas Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2003012302 A2 20030115, 14 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2002-117170 20020419. PRIORITY: JP 2001-125997 20010424.

AB The system includes a reformer for reforming the raw **fuel** with **steam** and/or **air** in the presence of reforming catalyst to form reforming gas, a CO selective oxidn. reactor for producing H-rich gas by selective oxidn. of CO in the reforming gas with oxygen in the presence of oxidn. catalyst to be CO2, and a device arranged between the reformer and the oxidn. reactor, for removing steam from the reforming gas by condensation sepn., to improve operation of the reactor for reducing CO concn.

IC ICM C01B003-38
ICS C01B003-48; H01M008-06; H01M008-10

CC **49-1** (Industrial Inorganic Chemicals)
Section cross-reference(s): 51, 52

ST **fuel cell** reforming hydrogen system carbon monoxide removal

IT Condensation (physical)
Fuel cells
Fuel gas manufacturing
Reforming
Reforming apparatus
Reforming catalysts
Solid state **fuel cells**
Steam
Steam reforming
Steam reforming catalysts
(**fuel** reforming system to produce hydrogen-rich gas for **fuel cells**)

IT Oxidation
Oxidation catalysts
(selective; fuel reforming system to produce hydrogen-rich gas for **fuel cells**)

IT 7440-18-8, Ruthenium, uses
(fuel reforming system to produce hydrogen-rich gas for **fuel cells**)

IT 124-38-9, Carbon dioxide, processes 630-08-0, Carbon monoxide, processes
(fuel reforming system to produce hydrogen-rich gas for **fuel cells**)

IT 1333-74-0P, Hydrogen, preparation

(fuel reforming system to produce hydrogen-rich gas for **fuel cells**)

L26 ANSWER 4 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2003:20904 Document No. 138:75928 Hydrogen production by steam reforming and **fuel cell** for hydrogen storage and power generation. Higashiyama, Kazutoshi; Komachiya, Masahiro; Hiyama, Kiyoshi; Kamo, Tomoichi; Imada, Noriyuki; Okano, Tetsurou; Kaku, Hiroyuki (Hitachi, Ltd., Japan; Babcock-Hitachi Kabushiki Kaisha). Eur. Pat. Appl. EP 1273552 A2 20030108, 35 pp. DESIGNATED STATES: R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR. (English). CODEN: EPXXDW. APPLICATION: EP 2002-2722 20020206. PRIORITY: JP 2001-203429 20010704; JP 2001-274920 20010911.

AB Hydrogen is produced by steam reforming of methane or methanol. The reformer is equipped with valves to control the supply of hydrocarbon and water according to the desired hydrogen prodn. vol. and the supply of oxidant (air or oxygen) to maintain a preset temp. A polymer electrolyte **fuel cell** for generation of elec. power with means for hydrogen storage is connected to the outlet of the reformer. Exhaust heat from the **fuel cell** is recovered by heat exchange to provide hot water to the reformer.

IC ICM C01B003-32
ICS C01B003-38; B01J019-00; H01M008-06

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 48, **49**, 52

ST hydrogen prodn steam reforming polymer electrolyte **fuel cell**; heat exchange hydrogen prodn steam reforming **fuel cell** electricity

IT Power
(generation; hydrogen prodn. by steam reforming and **fuel cell** for hydrogen storage and power generation)

IT **Air**
Heat transfer
Process control
Steam reforming
(hydrogen prodn. by **steam** reforming and **fuel cell** for hydrogen storage and power generation)

IT **Fuel cells**
(polymer electrolyte; hydrogen prodn. by steam reforming and **fuel cell** for hydrogen storage and power generation)

IT 1333-74-0P, Hydrogen, uses
(hydrogen prodn. by steam reforming and **fuel cell** for hydrogen storage and power generation)

IT 67-56-1, Methanol, reactions 74-82-8, Methane, reactions 7782-44-7, Oxygen, reactions

(hydrogen prodn. by steam reforming and **fuel cell** for hydrogen storage and power generation)

L26 ANSWER 5 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2003:14235 Document No. 138:76116 Apparatus for feeding of raw materials for production of hydrogen by reforming. Kondo, Yasuo; Uehara, Masanori (Denso Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2003002604 A2 20030108, 15 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-183891 20010618.

AB The app. has a feeding unit for gas-phase or liq.-phase water and air and a unit for heating of the gas-phase or liq.-phase water and air at the downstream side of the feeding unit in a flow path. The feeding unit has a flow-controlling unit for forming a fluidized bed of the gas-phase or liq.-phase water at the center of the flow path and forming a fluidized bed of air at the surrounding part. Preferably, the app. has a 2nd feeding unit contg. porous materials for feeding of 2nd raw materials contg. H compds. at the downstream side of the heating unit. The app. enables mixing of the raw materials at appropriate mixing ratios and feeding of mixed raw materials of high quality into a reformer for prodn. of H gas for **fuel cells.**

IC ICM C01B003-32
ICS B01J008-00; C01B003-38

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): **49**

ST feeding app hydrogen manuf fuel reforming; water **air** mixing **fuel steam** reforming

IT Air
Feeding apparatus
Fuel gases
Heat exchangers
Mixers (processing apparatus)
Porous materials
Steam
(app. for mixing and feeding of raw materials for steam reforming to produce hydrogen for **fuel cells**)

IT **Fuel cells**
(power plants; app. for mixing and feeding of raw materials for steam reforming to produce hydrogen for **fuel cells**)

IT Nozzles
(spray; app. for mixing and feeding of raw materials for steam reforming to produce hydrogen for **fuel cells**)

IT Fuel gas manufacturing
(steam reforming; app. for mixing and feeding of raw materials for steam reforming to produce hydrogen for **fuel cells**)

IT Reforming apparatus

(steam; app. for mixing and feeding of raw materials for steam reforming to produce hydrogen for **fuel cells**)
IT 7732-18-5, Water, processes
(app. for mixing and feeding of raw materials for steam reforming to produce hydrogen for **fuel cells**)
IT 1333-74-0P, Hydrogen, uses
(app. for mixing and feeding of raw materials for steam reforming to produce hydrogen for **fuel cells**)

L26 ANSWER 6 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2002:869415 Document No. 137:355256 Autothermal steam reforming-partial oxidn. of hydrocarbons for manufacture of hydrogen and/or synthesis gas with heat transfer for preheating reactants. Goebel, Steven G.; Burch, Steven D.; Pettit, William Henry (USA). U.S. Pat. Appl. Publ. US 2002168316 A1 20021114, 4 pp. (English). CODEN: USXXCO. APPLICATION: US 2001-853400 20010514.
AB Autothermal reformers and steam reforming app., for converting **air, steam,** and a hydrocarbon **fuel** into a reformate gas (esp. for manuf. of hydrogen, with water gas shift reaction for manuf. of addnl. hydrogen from carbon dioxide), is characterized by preheating the air and steam reactants with reformate gas exiting the reformer. The preheating may involve multiple heat exchangers and multiple heat transfer steps, in which (for example) the preheated steam from a first heat exchanger may be cooled in an intermediate step and then preheated again in a following heat-transfer step. The multiple heat transfer steps take place within a common housing, with no direct heat exchange between the reformate and the air.
IC ICM C01B003-24
NCL 423652000
CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): **49**

L26 ANSWER 7 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2002:777793 Document No. 137:281657 Fuel gas reformer assemblage. Lesieur, Roger R. (International Fuel Cells, LLC, USA). PCT Int. Appl. WO 2002078837 A1 20021010, 10 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US30953 20011002. PRIORITY: US 2000-PV237491 20001004.
AB A fuel gas-steam reformer assembly, preferably an autothermal reformer assembly, for use in a **fuel cell** power

plant, includes a mixing station for intermixing a relatively high mol. wt. **fuel** and an **air-steam** to form a homogeneous **fuel-air-steam** mixt. for admission into a catalyst bed. The catalyst bed includes catalyzed alumina pellets, or a monolith such as a foam or honeycomb body which is preferably formed from a high temp. material such as a steel alloy, or from a ceramic material. The catalyst bed is contained in a shell which is preferably formed from stainless steel or some other high temp. alloy. The shell includes an internal peripheral thermal insulation layer of zirconia (ZrO2), either in a felt form, or in a rigidified foam. The zirconia insulation layer provides thermal insulation for the shell and retains heat in the catalyst bed and protects the shell against thermal degrdn. from the hot catalyst bed: an it also protects the catalyst bed against carbon deposition from the fuel and oxygen mixt. flowing through the catalyst bed. The use of an internal zirconia insulation layer obviates the need to provide an alumina washcoat and metal oxide coatings on the inner surface of the shell for inhibiting carbon deposition in the catalyst bed. The zirconia insulation layer is non-acidic and possesses carbon gasification properties which are similar to the carbon gasification properties possessed by calcium and alkali metal oxides. Unlike silica insulation, zirconia insulation does not vaporize in the presence of high temp. steam.

IC ICM B01J019-02

CC 51-11 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 52

IT **Fuel cells**
(power plants; **fuel** gas reformer assemblage with zirconia insulation)

L26 ANSWER 8 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN

2002:656350 Document No. 137:203953 **Fuel cell** power plant and its operation. Kiyota, Toru (Fuji Electric Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2002246060 A2 20020830, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2001-44538 20010221.

AB The power plant for air conditioned building has: a **fuel cell** stack supplied with a fuel gas and **air**, a reformer for **steam** reforming a raw **fuel** into fuel gas, a system circulating **fuel cell** cooling water and supplying steam for the reformer, a system condensing and recovering water from the reformer combustion gas and/or the **fuel cell** waste gas and supplying the condensate to the cooling water circulating system; and a pipe supplying part of the air conditioner condensate, collected during operation of the air conditioner, to the condensate recovering system. The power plant may also have a pipe supplying part of the condensate from the **fuel cell** condensate recovering system to the

humidifier of the air conditioner. The power plant is operated by: stopping supply of **fuel cell** condensate to the **fuel cell** cooling system, and supplying air conditioner condensate to the cooling system, when the air conditioner is in use; and supplying the **fuel cell** condensate to the **fuel cell** cooling system and stopping the supply of air conditioner condensate, when the air conditioner is stopped.

IC ICM H01M008-06
ICS F24F003-14; H01M008-00; H01M008-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** power plant air conditioning humidifier condensate recovery; air conditioning building **fuel cell** power plant structure operation

IT **Fuel cells**
(power plants; water circulation between **fuel cell** power plant and air conditioner and their operation for buildings)

IT Air conditioning
Recycling
(water circulation between **fuel cell** power plant and air conditioner and their operation for buildings)

L26 ANSWER 9 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN

2002:450066 Document No. 137:8661 Process for air enrichment in producing hydrogen for use with **fuel cells.**
Towler, Gavin P.; Doshi, Kishore J. (UOP LLC, USA). PCT Int. Appl. WO 2002047191 A2 20020613, 29 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US47996 20011205. PRIORITY: US 2000-733362 20001208.

AB Hydrogen generation and **fuel cell** operation are integrated through the use of a fuel processor or hydrogen generation zone which comprises a pre-reforming zone, a partial oxidn. zone, a reforming zone, a water gas shift zone and a preferential oxidn. zone. According to the present invention, an oxygen-enriched stream is provided to the fuel processor and to the **fuel cell** from the adsorption effluent withdrawn from an adsorption zone. The oxygen-enriched stream is depleted in nitrogen which improved the efficiency of the fuel processor and the **fuel cell** by reducing nitrogen diln. A further

advantage resulted in **fuel** processor/**fuel cell** systems which burn the anode waste gas in a combustion zone to provide heat to the fuel processor zone. By dilg. the anode waste gas with an oxygen-reduced gas, it is possible to maintain the combustion temp. in the convection range and reduce or eliminate the amt. of excess air employed in the combustion zone.

IC ICM H01M008-06
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST **fuel cell** air enrichment hydrogen prodn
IT Water gas shift reaction
(app.; process for air enrichment in producing hydrogen for use with **fuel cells**)
IT Adsorption
(pressure-swing; process for air enrichment in producing hydrogen for use with **fuel cells**)
IT **Fuel cells**
Waste gases
(process for air enrichment in producing hydrogen for use with **fuel cells**)
IT Hydrocarbons, processes
Natural gas, processes
(process for air enrichment in producing hydrogen for use with **fuel cells**)
IT **Fuel** gas manufacturing
(**steam** reforming; process for **air** enrichment in producing hydrogen for use with **fuel cells**)
IT Adsorption
(thermal-swing; process for air enrichment in producing hydrogen for use with **fuel cells**)
IT Adsorption
(vacuum-swing; process for air enrichment in producing hydrogen for use with **fuel cells**)
IT 74-82-8, Methane, processes 630-08-0, Carbon monoxide, processes 7782-44-7, Oxygen, processes
(process for air enrichment in producing hydrogen for use with **fuel cells**)
IT 124-38-9, Carbon dioxide, formation (nonpreparative)
(process for air enrichment in producing hydrogen for use with **fuel cells**)
IT 1333-74-0P, Hydrogen, uses
(process for air enrichment in producing hydrogen for use with **fuel cells**)

L26 ANSWER 10 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2002:449558 Document No. 137:8449 Method and apparatus for catalytic reducing carbon monoxide content of hydrogen-rich gas for **fuel cells.** Stevens, James F.; Krause, Curtis F.;

Naa, Doug (Texaco Development Corporation, USA). PCT Int. Appl. WO 2002045836 A1 20020613, 17 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US47304 20011205. PRIORITY: US 2000-PV251226 20001205.

AB The method and app. for reducing the CO content of a H rich gas includes a catalyst bed contg. an oxidn. catalyst, a porous tube positioned substantially within the catalyst bed for distributing an O-contg. stream throughout the catalyst bed, and a cooling jacket for maintaining operating temp. of the catalyst bed in a desired range. The porous tube can be constructed as a sintered stainless steel tube or as an Al2O3 tube or as any equiv. porous tube that is known to these skilled in the art to perform the objectives of this method and app. The porous tube is generally positioned along the length of the catalyst bed in a manner that optimizes dispersion of the O-contg. stream throughout the catalyst bed. Operating temp. of the catalyst bed is controlled by a cooling jacket to form .apprx.90° to .apprx.180°, more preferably from .apprx.90° to 150°. The cooling jacket contains a circulating coolant that can be H2O, **steam**, **air**, or the hydrocarbon **fuel** to the fuel processor.

IC ICM B01J004-00

CC 51-6 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): **49**, 52

ST oxidn catalyst reducing carbon monoxide hydrogen gas **fuel cell**; porous tube catalytic oxidn carbon monoxide cooling coolant

IT Coolants
Cooling apparatus
Fuel cells
Oxidation catalysts
Pipes and Tubes
Water gas shift reaction
(method and app. for catalytic reducing carbon monoxide content of hydrogen-rich gas for **fuel cells**)

IT 1344-28-1, Alumina, uses 12597-68-1, Stainless steel, uses
(method and app. for catalytic reducing carbon monoxide content of hydrogen-rich gas for **fuel cells**)

IT 1333-74-0, Hydrogen, uses
(method and app. for catalytic reducing carbon monoxide content of hydrogen-rich gas for **fuel cells**)

IT 630-08-0, Carbon monoxide, reactions
(method and app. for catalytic reducing carbon monoxide content of hydrogen-rich gas for **fuel cells**)

L26 ANSWER 11 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2002:238099 Document No. 136:250307 Startup and shutdown of reformer for polymer electrolyte **fuel cell.** Yamazeki, Kenichi; Fujiki, Hiroshi (Tokyo Gas Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2002093447 A2 20020329, 13 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-280284 20000914.

AB To prevent oxidn. of reforming catalyst during the starting up of a reformer system contg. a reformer, a CO converter, and a CO oxidn. reactor; the compn. of a gas flow selected from O contg. **air** or combustion gas, **steam,** raw **fuel** gas, and N passing through the catalyst is adjusted according the heating of the catalyst. During the shutdown of the reformer system, a raw fuel-steam mixt. is supplied until the catalyst temp. is cooled to 400°, steam is used to purge the reformer while cooling from 400° to 300°, and air is used to purge below 300° to prevent oxidn.

IC ICM H01M008-04
ICS H01M008-04; H01M004-90; H01M008-06; H01M008-10

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell reformer** startup shutdown **catalyst** oxidn prevention

IT Air
Combustion gases
Fuel cells
Steam
(adjustment of purging gas compn. according to catalyst temp. during reformer startup and shutdown for polymer electrolyte **fuel cells**)

IT Fuel gases
(city gas; adjustment of purging gas compn. according to catalyst temp. during reformer startup and shutdown for polymer electrolyte **fuel cells**)

IT 7440-02-0, Nickel, uses
(adjustment of purging gas compn. according to catalyst temp. during reformer startup and shutdown for polymer electrolyte **fuel cells**)

IT 7727-37-9, Nitrogen, uses
(adjustment of purging gas compn. according to catalyst temp. during reformer startup and shutdown for polymer electrolyte **fuel cells**)

L26 ANSWER 12 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2002:122550 Document No. 136:169890 Procedure for operation of a fuel processor, which combines partial oxidation and steam reforming.

Borup, Rodney L.; Pettit, William H. (General Motors Corporation, USA). Ger. Offen. DE 10127199 A1 20020214, 14 pp. (German). CODEN: GWXXBX. APPLICATION: DE 2001-10127199 20010605. PRIORITY: US 2000-626553 20000727.

AB The system includes a reactor with 1 or more catalytic beds which is fed with a hydrocarbon **fuel**, **air**, and **steam**. If >1 catalytic bed is present, the beds are preferably arranged successively so that the outlet of a bed leads into the inlet of the next bed. The catalytic beds are in ranges, at which reactions between the hydrocarbon, air, and steam are catalyzed within the reactor. The procedure covers the supply of a stream of a lean fuel-air mixt. to the reactor. The mixt. is lean if it contains an excess amt. of O2 relative to the stoichiometric amt. which is required for reaction with the fuel. The reactions, which take place with the lean mixt., warm up the reactor. If >1 catalytic bed is present, the hot gases, which are produced by a catalytic bed, can be used to warm up other catalytic beds. After a sufficient heating of the reactor by the lean mixt., a fuel-rich stream is fed to the reactor. The fuel-rich mixt. includes the fuel, air, and water in the form of steam. The mixt. is rich if it contains an excess amt. of fuel relative to the stoichiometric amt. which is required for the reaction. The rich mixt. reacts in the reactor to produce a H-rich product. The resulting product is suitable for manuf. of H2 used in **fuel cells**.

IC ICM C01B003-34

CC **49-1** (Industrial Inorganic Chemicals)
Section cross-reference(s): 52

ST steam reforming partial oxidn hydrogen manuf; synthesis gas manuf reforming; **fuel cell** hydrogen manuf

IT **Fuel cells**
(combined partial oxidn. and steam reforming in manuf. of hydrogen for)

IT Steam reforming
(combined partial oxidn. and steam reforming in manuf. of hydrogen for **fuel cells**)

IT Oxidation
(partial; combined partial oxidn. and steam reforming in manuf. of hydrogen for **fuel cells**)

L26 ANSWER 13 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN

2002:90512 Document No. 136:137084 Plasmatron-catalyst system for hydrogen-rich gas generation. Bromberg, Leslie; Cohn, Daniel R.; Rabinovich, Alexander; Alexeev, Nikolai (USA). U.S. Pat. Appl. Publ. US 20020012618 A1 20020131, 10 pp., Cont.-in-part of U.S. Ser. No. 182,537, abandoned. (English). CODEN: USXXCO. APPLICATION: US 2001-960046 20010921. PRIORITY: US 1998-182537 19981029.

AB A plasmatron-catalyst system generates hydrogen-rich gas and comprises a plasmatron and at least one catalyst for receiving an

output from the plasmatron to produce hydrogen-rich gas. In a preferred embodiment, the plasmatron receives as an input **air, fuel** and water/**steam** for use in the reforming process. The system increases the hydrogen yield and decreases the amt. of carbon monoxide.
IC ICM B01J007-00
ICS B01J008-00
NCL 422190000
CC **49-1** (Industrial Inorganic Chemicals)
Section cross-reference(s): 17, 52, 54
IT Chemical industry
Diesel engines
Food processing
Fuel cells
Fuel gas manufacturing
Hydrogenation
Internal combustion engines
Metallurgy
Plasmatrons
Steam reforming catalysts
Vehicles
Water gas shift reaction catalysts
(plasmatron-catalyst system for hydrogen-rich gas generation)

L26 ANSWER 14 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2002:27727 Document No. 136:88403 **Fuel cell** power-generating system without water condensation. Nagata, Yuji; Kanie, Naoki (Toshiba Corp., Japan). Jpn. Kokai Tokkyo Koho JP 2002008700 A2 20020111, 8 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 2000-185642 20000621.
AB The system has a reforming device for generating H-rich gas from fuel and steam and a **fuel cell** operated at around 100° or lower than that. In the system, a gas for decreasing the partial pressure of the steam is supplied to the reforming device, or alternatively, bypass pipings are formed for avoiding steam supply to the **fuel cell** during starting or stopping stage of the system. Water condensation close to the **fuel cell** is prevented even when the reforming device is in high humidity conditions.
IC ICM H01M008-04
ICS H01M008-04; H01M008-06; H01M008-10
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST **fuel cell** power generating system water condensation prevention
IT **Fuel cells**
(**fuel cell** power-generating system without water condensation close to **fuel cell**)
IT **Air**

(**steam** pressure-decreasing gas; **fuel cell** power-generating system without water condensation close to **fuel cell**)
IT 7727-37-9, Nitrogen, uses
(steam pressure-decreasing gas; **fuel cell** power-generating system without water condensation close to **fuel cell**)

L26 ANSWER 15 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2001:935477 Document No. 136:56437 Fuel gas reformer assemblage for use in **fuel cell** power plant. Lesieur, Roger R. (International Fuel Cells, LLC, USA). PCT Int. Appl. WO 2001097960 A1 **20011227**, 18 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US18429 20010607. PRIORITY: US 2000-598205 20000621.
AB The title assemblage includes a mixing station for mixing fuel and air prior to admission into a catalyst bed. The air-steam stream is fed into a manifold in the mixing station. The mixing station comprises a plurality of tubes that open into the catalyst bed after passing through the manifold. The tubes contain tangential openings that connect the interiors of the tubes with the manifold. Each opening has an axis that is tangential to the circumference of the tube. A first set of openings are tangential in one direction, and a second set of openings are tangential in the opposite direction. This opposition reduces swirling, while resulting in an intimate admixt. of **fuel**, **air** and **steam**. The fuel., with a mol. wt. preferably higher than methane, may contain steam.
IC ICM B01J008-02
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST **fuel cell** power plant **fuel** gas steam reformer
IT Hydrocarbons, reactions
(fuel gas reformer assemblage for use in **fuel cell** power plant)
IT **Fuel cells**
(power plants; **fuel** gas reformer assemblage for use in **fuel cell** power plant)
IT Fuel gas manufacturing
(steam reforming; fuel gas reformer assemblage for use in **fuel cell** power plant)

IT Reforming apparatus
(steam; fuel gas reformer assemblage for use in **fuel cell** power plant)
IT 74-82-8, Methane, reactions 74-84-0, Ethane, reactions
(fuel gas reformer assemblage for use in **fuel cell** power plant)
IT 1333-74-0P, Hydrogen, uses
(fuel gas reformer assemblage for use in **fuel cell** power plant)

L26 ANSWER 16 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2001:904841 Document No. 136:22010 Joint-cycle high-efficiency **fuel cell** system with power generating turbine. Clawson, Lawrence G.; Hagan, Mark R. (Nuvera, Inc., USA; Nuvera Fuel Cells). PCT Int. Appl. WO 2001095409 A2 **20011213**, 40 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US17437 20010531. PRIORITY: US 2000-PV208355 20000531; US 2001-870412 20010530.

AB The efficiency of a combination reformer/**fuel cell** system is significantly improved by recapturing the energy value of heat generated in the **fuel cell** and producing addnl. power. The cooling water from the **fuel cell** is mixed, entirely or in part, with sufficient or excess compressed air, and at least partially evaps. in the compressed air. The air is at least sufficient to support the oxidative reactions in the **fuel cell** and also to serve as oxidant in a burner that provides heat to reform fuel/steam mixts. into hydrogen-contg. reformate. This **air/ steam** mixt., after leaving the **fuel cell**, is further heated by heat exchange with the reformate stream and reformate-producing modules, and with the exhaust stream of the burner. The steam/air mixt. is injected into the burner optionally after superheating in the burner exhaust, and is reacted with fuel in the burner. The burner exhaust may be used to provide heat to a fuel reforming reaction. The high-temp. burner exhaust may also be used to drive an expander, preferably a turbine, at a location in the system which is downstream of the burner, but in which the exhaust is at a high temp. so as to run the turbine efficiently. The turbine recovers heat energy from the **fuel cell** as mech. energy, typically in excess of the energy required to run a compressor, because of the addn. of steam to the

compressed air. Moreover, system heat removal elements, such as radiators, as well as overall system size and cost, can be markedly reduced for a given level of output.

IC ICM H01M

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 48

ST **fuel cell** system power generating turbine; waste heat **fuel cell** system turbine

IT Methanation
(CO; joint-cycle high-efficiency **fuel cell** system with power generating turbine)

IT Membranes, nonbiological
(H-selective; joint-cycle high-efficiency **fuel cell** system with power generating turbine)

IT Reforming
(autothermal; joint-cycle high-efficiency **fuel cell** system with power generating turbine)

IT Power
(generation; joint-cycle high-efficiency **fuel cell** system with power generating turbine)

IT Waste gases
(heat recovery from; joint-cycle high-efficiency **fuel cell** system with power generating turbine)

IT **Fuel cells**
Heat exchangers
Oxidation
Reforming apparatus
Steam reforming
Thermodynamic cycle
Turbines
Waste heat
Water gas shift reaction
(joint-cycle high-efficiency **fuel cell** system with power generating turbine)

IT Oxidation
(partial; joint-cycle high-efficiency **fuel cell** system with power generating turbine)

IT **Fuel cells**
(power plants; joint-cycle high-efficiency **fuel cell** system with power generating turbine)

IT Adsorption
(pressure-swing; joint-cycle high-efficiency **fuel cell** system with power generating turbine)

IT Fuel gas manufacturing
(reforming; joint-cycle high-efficiency **fuel cell** system with power generating turbine)

IT Adsorption
(thermal-swing; joint-cycle high-efficiency **fuel**

cell system with power generating turbine)

IT 1333-74-0P, Hydrogen, uses
(joint-cycle high-efficiency **fuel cell** system with power generating turbine)

IT 630-08-0, Carbon monoxide, reactions
(joint-cycle high-efficiency **fuel cell** system with power generating turbine)

L26 ANSWER 17 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2001:545555 Document No. 135:95044 Autothermal fuel gas reformer assemblage for **fuel cell** power plant. Lesieur, Roger R.; Szydlowski, Donald F.; Barber, Thomas J.; Chiappetta, Louis M.; Peschke, William O. (International Fuel Cells, LLC, USA). PCT Int. Appl. WO 2001052978 A1 **20010726**, 21 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US2183 20010123. PRIORITY: US 2000-490679 20000124.

AB A tubular fuel gas-steam reformer assembly, preferably an autothermal reformer assembly, for use in a **fuel cell** power plant, includes a **fuel-steam** vaporizer , a **fuel-steam** (A) and **air** (B) mixing station, and a catalyst bed. The catalyst bed can include catalyzed Al2O3 pellets, or a monolith such as a foam or honeycomb body which is preferably formed from a high temp. material such as a steel alloy, or from a ceramic material. The (A) is vaporized in the vaporizer and then passes into the mixing station. The mixing station comprises a plurality of mixing tubes which open into the catalyst bed. The mixing tubes extend through a manifold and include openings which interconnect the interior of the tubes with the manifold. The openings have axes which are perpendicular to the axis of each of the mixing tubes , and are positioned on the tubes at locations which are dictated by the diam. of the mixing tubes and which will ensure through mixing of the (B) and (A) streams. A preferred mode of operation involves introducing the (A) into the mixing tubes from the vaporizer and feeding the (B) into the manifold. The delta P between the **air** supply (B) and the **fuel-steam** stream (A) is relatively small.

IC ICM B01J008-02

CC 51-23 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): **49**, 52

IT Air

Diesel fuel
Fuel gases
Reforming apparatus
Reforming **catalysts**
Steam
Synthesis gas
(autothermal fuel gas **reformer** assemblage for **fuel cell** power plant)
IT Gasoline
(autothermal fuel gas reformer assemblage for **fuel cell** power plant)
IT Fuels
(liq.; autothermal fuel gas reformer assemblage for **fuel cell** power plant)
IT **Fuel cells**
(power plants; autothermal fuel gas reformer assemblage for **fuel cell** power plant)
IT Reforming apparatus
(steam; autothermal fuel gas reformer assemblage for **fuel cell** power plant)
IT Reactors
(tubular; autothermal fuel gas reformer assemblage for **fuel cell** power plant)
IT 1344-28-1, Alumina, uses 7440-02-0, Nickel, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses
(autothermal fuel gas reformer assemblage for **fuel cell** power plant)
IT 67-56-1, Methanol, uses
(autothermal fuel gas reformer assemblage for **fuel cell** power plant)

L26 ANSWER 18 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2001:290801 Document No. 134:298430 Fuel reformer for **fuel cell** system. Mitsushima, Shigenori; Yamaga, Kenji; Imahashi, Jinichi; Kamo, Tomokazu (Hitachi Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2001114502 A2 **20010424**, 12 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-291084 19991013.
AB H2-based reforming gas is manufd. from material contg. 2 or 3 components selected from hydrocarbon, **steam** and **air** in a **fuel** reformer comprising a based reactor, multiple load-response reactors which are arranged in an equal distance to the based reactor, and a distributor for supplying material into reactors based on the hydrogen load quantity. Load-responsiveness of the reformer is high and the catalyst temp. in load-response reactor during idle situation can be maintained at a working temp. The reformer can be applied to a **fuel cell** system.
IC ICM C01B003-38

ICS F02M027-02; H01M008-06; H01M008-10
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST hydrcarbon refroming **fuel cell** system; reforming gas manuf **fuel cell** system
IT **Fuel cells**
Fuel gas manufacturing
Reforming apparatus
Steam reforming
(**fuel** reformer for **fuel cell** system)
IT Hydrocarbons, uses
(fuel reformer for **fuel cell** system)
IT 1333-74-0P, Hydrogen, preparation
(fuel reformer for **fuel cell** system)

L26 ANSWER 19 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2001:200336 Hydrogen manufacturing using low current, non-thermal plasma boosted fuel converters. Bromberg, Leslie; Cohn, D. R.; Rabinovich, A.; Alexeev, N. (Plasma Science and Fusion Center, MIT, Cambridge, MA, 02139, USA). Abstracts of Papers - American Chemical Society, 221st, FUEL-001 (English) **2001**. CODEN: ACSRAL. ISSN: 0065-7727. Publisher: American Chemical Society.
AB Hydrogen-rich gas can be efficiently produced in compact plasma reformers with a variety of hydrocarbon fuels including natural gas and diesel. A novel type of plasma reformers, based on low current, high voltage non-thermal plasmatron which we have recently developed, has been investigated. Use of the nonthermal plasmatron greatly reduces the specific elec. energy consumption and the electrode wear. The performance of the novel plasmatron configuration will be described. The paper will describe reforming expts. with diesel or methane. The compn. of the reformate for varying **air-steam-fuel** ratios, varying throughput and varying elec. power will be reported. The technol. is being developed for hydrogen manufg. for a variety of stationary applications including distributed, low pollution electricity generation from **fuel cells**; hydrogen-refueling gas stations for **fuel cell** driven cars; and decentralized hydrogen generation for industrial processes. It is also being developed to be used for mobile applications.

L26 ANSWER 20 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2001:58515 Document No. 134:118251 Fuel carburetor and mixed gas production device to produce hydrogen for **fuel cell**. Hirai, Etsuo; Matsuda, Naohiko; Horie, Shigenari; Yagi, Katsuki (Mitsubishi Heavy Industries, Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2001019976 A2 **20010123**, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-196015 19990709.
AB The device includes a partial oxidn. burner for prodn. of

combustible gas contg. mainly H2, a 1st catalyst for partial oxidn. and steam reforming by mixing the produced gas with liq. **fuel** (e.g., methanol); **steam**; and **air**, a 2nd catalyst to reduce the CO concn. in the mixed gas by the steam, a 3rd catalyst for further removing residual CO, and a bubbling evaporator connecting to the burner for mixing liq. fuel with air to a satd. partial pressure for supplying air/fuel mixed gas to the burner from the evaporator at start time.

IC ICM C10K003-04
ICS C01B003-32; C01B003-38; F23K005-22; H01M008-04; H01M008-06

CC 51-19 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): **49**, 52

IT Control apparatus
Mixers (processing apparatus)
(carburetors; fuel carburetor and mixed gas prodn. device to produce hydrogen for **fuel cell**)

IT Air
Burners
Evaporators
Fuel cells
Fuel gas manufacturing
Steam
Steam reforming
(**fuel** carburetor and mixed gas prodn. device to produce hydrogen for **fuel cell**)

IT Fuels
(liq.; fuel carburetor and mixed gas prodn. device to produce hydrogen for **fuel cell**)

IT Oxidation
(partial; fuel carburetor and mixed gas prodn. device to produce hydrogen for **fuel cell**)

IT 1333-74-0, Hydrogen, uses
(fuel carburetor and mixed gas prodn. device to produce hydrogen for **fuel cell**)

IT 67-56-1, Methanol, uses
(fuel carburetor and mixed gas prodn. device to produce hydrogen for **fuel cell**)

IT 630-08-0, Carbon monoxide, processes
(fuel carburetor and mixed gas prodn. device to produce hydrogen for **fuel cell**)

L26 ANSWER 21 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2000:861553 Document No. 134:19398 Compact lightweight autothermal fuel gas steam reformer assembly for **fuel cell** power plants. Lesieur, Roger R. (International Fuel Cells, LLC, USA). PCT Int. Appl. WO 2000072954 A1 **20001207**, 21 pp. DESIGNATED STATES: W: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM,

HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE. (English). CODEN: PIXXD2. APPLICATION: WO 2000-US13933 20000519. PRIORITY: US 1999-321390 19990527.

AB A fuel gas-steam reformer assembly, preferably an autothermal reformer assembly, for use in a **fuel cell** power plant, includes a catalyst bed which is formed from a cylindrical monolithic open cell foam body. The foam body is preferably formed from a high temp. material such as stainless steel, nickel alloys and iron-aluminum alloys, or from a ceramic material. The foam body includes open cells or pores which are contained within the metal or ceramic lattice. The lattice is coated with a porous wash coat which serves as a high surface area substrate onto which catalysts used in the reformer are applied. The foam body has an inlet end into which a mixt. of **fuel**, **steam** and **air** is fed to begin the reforming process. An inlet portion of the foam body may be provided with an iron oxide and/or noble metal catalyst and the remainder of the foam body may be provided with a nickel and/or noble metal catalyst.

IC ICM B01J008-02

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST reformer assembly **fuel cell** power plant; steam reformer assembly **fuel cell** power plant

IT Steam reforming catalysts
(compact lightwt. autothermal fuel gas steam reformer assembly for **fuel cell** power plants)

IT Noble metals
(compact lightwt. autothermal fuel gas steam reformer assembly for **fuel cell** power plants)

IT Hydrocarbons, uses
(compact lightwt. autothermal fuel gas steam reformer assembly for **fuel cell** power plants)

IT Ceramics
(foam; compact lightwt. autothermal fuel gas steam reformer assembly for **fuel cell** power plants)

IT **Fuel cells**
(power plants; compact lightwt. autothermal fuel gas steam reformer assembly for **fuel cell** power plants)

IT Fuel gas manufacturing
(synthesis gas, partial oxidn., steam reforming; compact lightwt. autothermal fuel gas steam reformer assembly for **fuel cell** power plants)

IT Nickel alloy, base
(foam; compact lightwt. autothermal fuel gas steam reformer assembly for **fuel cell** power plants)

IT 1305-78-8, Calcium oxide, uses 1332-37-2, Iron oxide, uses

7440-02-0, Nickel, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses
(compact lightwt. autothermal fuel gas steam reformer assembly for **fuel cell** power plants)

IT 11114-60-6 12597-68-1, Stainless steel, uses
(foam; compact lightwt. autothermal fuel gas steam reformer assembly for **fuel cell** power plants)

L26 ANSWER 22 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2000:790416 Document No. 133:337295 Autothermal reforming system with integrated shift beds, preferential oxidation reactor, auxiliary reactor, and system controls. Bentley, Jeffrey M.; Block, Stephen Gustav; Bowers, Brian; Chintawar, Prashant S.; Clawson, Lawrence G.; Cross, James C., III; Davis, Robert; Dorson, Matthew H.; Hagan, Mark R.; Kleeberg, Gunther; Mitchell, William L.; Morriseau, Brian D.; Nowicki, Brian J.; Papile, Christopher; Pollica, Darryl; Prabhu, Srinivasa; Qi, Frank C.; Rizzo, Vincent G.; Rumsey, Jennifer W.; Sun, Maria W.; Thijssen, Johannes; Thompson, Craig (Arthur D. Little, Inc., USA). PCT Int. Appl. WO 2000066487 A1 **20001109**, 129 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG. (English). CODEN: PIXXD2. APPLICATION: WO 2000-US12117 20000503. PRIORITY: US 1999-PV132184 19990503; US 1999-PV132259 19990503; US 2000-563677 20000502; US 2000-565288 20000502; US 2000-563676 20000502; US 2000-562787 20000502.

AB An integrated hydrocarbon reforming system for use with an assocd. **fuel cell**, the system including a gas generator having a partial oxidn. chamber, a steam reforming chamber, and integrated shift beds, a preferential oxidn. reactor, optionally including a second preferential oxidn. reactor and a chiller condenser interposed in-line with the two oxidn. reactors, an auxiliary reactor with preheating, combustion, and stream generation capabilities, and an integrated fluid system whereby water, **steam**, **fuel**, and **air** can be effectively shared between system components for increased efficiencies and operation. The gas generator is configured to generate hydrogen-rich reformate by carrying out at least one of a non-catalytic thermal partial oxidn., a catalytic partial oxidn., a steam reforming, and any combinations thereof. Within the shift beds a catalyst is used for promoting a water gas shift reaction in the hydrogen-rich reformate, while an integrated heat exchanger having a first mass of two-phase water therein is configured to

exchange heat between the two-phase water and the hydrogen-rich reformate in the shift beds.
IC ICM C01B003-48
CC **49-10** (Industrial Inorganic Chemicals)
Section cross-reference(s): 52
ST integrated shift bed autothermal reforming system **fuel cell**
IT Catalysts
Fuel cells
Gases
Heat exchangers
Heat transfer agents
Process control
Reactors
Steam
Steam reforming
Steam reforming catalysts
(auto-thermal reforming system with integrated shift beds, preferential oxidn. reactor, auxiliary reactor, and system controls)

L26 ANSWER 23 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2000:665874 Document No. 133:254964 **Fuel cell** power-generating apparatus with steam reformer.. Saito, Hajime (Ishikawajima-Harima Heavy Industries Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2000260446 A2 **20000922**, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1999-63937 19990310.
AB The title app. includes a **fuel cell** for generating electricity using H-contg. anode gas (e.g., city gas) and O-contg. cathode gas (e.g., **air**), a reformer for **steam** reforming **fuel** gas and supplying reformed gas (as anode gas) to the anode, a catalytic combustor for combustion of anode waste gas with cathode waste gas and the combustion waste gas is supplied to a heating chamber for heating the reformer and recycled to the cathode via a CO2 recycle pipeline and a blower, a device for heating feed water by waste heat of cathode waste gas to generate steam for the reformer. The **fuel cell** is a molten-carbonate **fuel cell** using blower of CO2 recycle pipeline for supplying air to cathode.
IC ICM H01M008-04
ICS H01M008-14
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 48, 59
ST **fuel cell** power generation app; molten carbonate **fuel cell** power generation; steam reformer **fuel cell** power generation; city gas steam reformer **fuel cell**

IT Combustion apparatus
(catalytic; molten-carbonate **fuel cell** power-generating app. with steam reformer)
IT Fuel gases
(city gas, steam reforming of; molten-carbonate **fuel cell** power-generating app. with steam reformer)
IT Waste gases
(combustor of; molten-carbonate **fuel cell** power-generating app. with steam reformer)
IT **Fuel cells**
(**fuel cell** power-generating app. with steam reformer)
IT Power
(generation, app. for; **fuel cell** power-generating app. with steam reformer)
IT **Fuel cells**
(molten carbonate; molten-carbonate **fuel cell** power-generating app. with steam reformer)
IT Steam reforming
(of city gas; molten-carbonate **fuel cell** power-generating app. with steam reformer)
IT Reforming apparatus
(steam; molten-carbonate **fuel cell** power-generating app. with steam reformer)
IT Waste heat
(utilization of; molten-carbonate **fuel cell** power-generating app. with steam reformer)
IT 1333-74-0, Hydrogen, reactions 7782-44-7, Oxygen, reactions
(**fuel cell** power-generating app. with steam reformer)
IT 124-38-9, Carbon dioxide, processes
(molten-carbonate **fuel cell** power-generating app. with steam reformer)

L26 ANSWER 24 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2000:470216 Document No. 133:152930 Design and evaluation of combined cycle system with solid oxide **fuel cell** and gas turbine. Tanaka, K.; Wen, C.; Yamada, K. (Global Industrial and Social Progress Research Institute, Minato, Tokyo, 105-0001, Japan). Fuel, 79(12), 1493-1507 (English) **2000**. CODEN: FUELAC. ISSN: 0016-2361. Publisher: Elsevier Science Ltd..
AB This study describes the basic design/evaluation of a combined cycle power generation system using solid oxide **fuel cells** in conjunction with a gas turbine. Factors included are system performance and cost/energy pay-back times (CPT/EPT). Total generation efficiency (Eth) was analyzed from the standpoint of plant size, cell performance, working pressure/temp., **steam** carbon ratio, **fuel/air** utilization

ratios (Uf/Ua) and turbine inlet temp. (TIT). A calcn. method for detg. the system life cycle cost and input energy requirements is also proposed. Results show that Eth is higher than that for conventional power plants; it has a working temp./pressure of 1073 K/0.4 MPa, Eth=68.3% with CPT=9.3 yr and EPT=0.71 yr with load following capability from 60 to 121% nominal load. The main parameters for detg. Eth, CPT and EPT were found to be working temp., cell performance, Ua and TIT limitation. Also discussed in detail are development areas and targets.

CC 51-23 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 52

ST **fuel cell** turbine power combined cycle

IT Chemical engineering design
Combustion
Fuel cells
Reforming
Turbines
Water gas shift reaction
(design and evaluation of combined cycle system with solid oxide **fuel cell** and gas turbine)

IT Power
(generation; design and evaluation of combined cycle system with solid oxide **fuel cell** and gas turbine)

IT Power
(plants; design and evaluation of combined cycle system with solid oxide **fuel cell** and gas turbine)

L26 ANSWER 25 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2000:218965 Document No. 132:310744 Hydrogen generation from biogenic and fossil fuels by autothermal reforming. Rampe, T.; Heinzel, A.; Vogel, B. (Fraunhofer Institute for Solar Energy Systems ISE, Freiburg, Germany). Journal of Power Sources, 86(1-2), 536-541 (English) **2000**. CODEN: JPSODZ. ISSN: 0378-7753. Publisher: Elsevier Science S.A..

AB Hydrogen generation for **fuel cell** systems by reforming technologies from various fuels is one of the main fields of investigation of the Fraunhofer ISE. Suitable fuels are, on the one hand, gaseous hydrocarbons like methane, propane but also, on the other hand, liq. hydrocarbons like gasoline and alcs., e.g., ethanol as biogenic fuel. The goal is to develop compact systems for generation of hydrogen from fuel being suitable for small-scale membrane **fuel cells**. The most recent work is related to reforming according to the autothermal principle - **fuel, air** and **steam** is supplied to the reactor. Possible applications of such small-scale autothermal reformers are mobile systems and also miniature **fuel cell** as co-generation plant for decentralized electricity and heat generation. For small stand-alone systems without a

connection to the natural gas grid liq. gas, a mixt. of propane and
butane is an appropriate fuel.
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 51
ST propane steam reforming autothermal hydrogen; **fuel**
cell hydrogen autothermal reforming
IT **Fuel cells**
(hydrogen generation from biogenic and fossil fuels by
autothermal reforming)

L26 ANSWER 26 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
2000:67783 Document No. 132:110614 Small-sized solid polymer
fuel cell system for efficient operation. Ozeki,
Masataka; Yamamoto, Yoshiaki (Matsushita Electric Industrial Co.,
Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 2000030726 A2
20000128, 8 pp. (Japanese). CODEN: JKXXAF. APPLICATION:
JP 1998-192001 19980707.
AB The system has a solid polymer **fuel cell**, a
steam reformer to produce H-rich gas, a CO modifier, units to
condense and collect **steam** contained in **air** and
fuel gas discharged from the **fuel cell**,
a means for supplying the collected water to fuel gas outlet
passage, to the reformer, and/or to the CO modifier, and a means for
control of the water flow. The system may have a cooling app. and
an app. to exchange heat and moisture between air fed into the
fuel cell and discharged air. The temp. and
moisture of the system can be controlled by using the heat and steam
recovered.
IC ICM H01M008-06
ICS H01M008-10
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST solid polymer **fuel cell** steam reforming; heat
exchange solid polymer **fuel cell**
IT **Fuel cells**
Heat exchangers
Steam
Steam reforming
(heat and steam recovery in solid polymer **fuel**
cell system for temp. and moisture control)
IT Heat
(recovery; heat and steam recovery in solid polymer **fuel**
cell system for temp. and moisture control)
IT 1333-74-0P, Hydrogen, uses
(heat and steam recovery in solid polymer **fuel**
cell system for temp. and moisture control)
IT 630-08-0, Carbon monoxide, processes
(heat and steam recovery in solid polymer **fuel**
cell system for temp. and moisture control)

L26 ANSWER 27 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1999:162167 Document No. 130:170680 **Fuel cell** power plants. Sakamoto, Shigeru; Oda, Katsuya; Miyake, Yasuo (Sanyo Electric Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 11067256 A2 **19990309** Heisei, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1997-230973 19970827.

AB The power plants have a reformer, partially oxidizing a **fuel** gas-**air** mixt. and **steam** reforming the partially oxidized gas to form a H based reformed gas, and **fuel cells** using the reformed gas for their anodes; where the reformer is installed in a container having an ambient air intake opening.

IC ICM H01M008-06
ICS C01B003-38; H01M008-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** power plant reformer

IT **Fuel cells**
(power plants; structure of reformers in **fuel cell** power plants)

IT Reforming apparatus
(structure of reformers in **fuel cell** power plants)

L26 ANSWER 28 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1999:27780 Document No. 130:83674 Method and device for autothermal reforming of hydrocarbons for manufacture of hydrogen. Maier-Roltgen, Uli; Schuler, Alexander; Finkbeiner, Hartmut (Fraunhofer-Gesellschaft zur Forderung der Andgewandten Forschung E.V., Germany). PCT Int. Appl. WO 9858874 A1 **19981230**, 27 pp. DESIGNATED STATES: W: JP, US; RW: AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE. (German). CODEN: PIXXD2. APPLICATION: WO 1998-EP3869 19980624. PRIORITY: DE 1997-19727841 19970624.

AB A method and a device for autothermal reforming of hydrocarbons, for manuf. of captive H2 (for manuf. of ammonia, methanol, etc.) or pure H2, includes a simultaneous combustion and reforming in the same area in the reaction zone, and heat exchange of part of the product reformate with incoming **fuel** and **air** or **steam**. The fuel is supplied directly to the reaction zone together with the other starting material to the catalytic reaction zone at such a temp. that carbon deposition, coking, and thermal cracking is inhibited. The process is esp. suitable for small-scale operations.

IC ICM C01B003-38

CC **49-1** (Industrial Inorganic Chemicals)
Section cross-reference(s): 51

L26 ANSWER 29 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1998:693112 Document No. 129:333314 Packed **fuel cell** power plants. Shinohara, Yoshihiro (Mitsubishi Electric Corp., Japan). Jpn. Kokai Tokkyo Koho JP 10289725 A2 **19981027** Heisei, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1997-94012 19970411.

AB The power plants have a reformer generating H from city gas and **steam**, a H/**air fuel cell** stack, an inverter, a means for recovering heat from the **fuel cell** stack and waste gas, and an air blower installed on a base plate, a frame built on the base plate, and side wall and ceiling plates on the frame; where the side wall and ceiling plates are laminates having a sound absorbing material on the inside face of a metal board.

IC ICM H01M008-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** power plant sound insulation

IT **Fuel cells**
(power plants; structure of sound insulated packed **fuel cell** power plants)

L26 ANSWER 30 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1996:646499 Document No. 125:280721 **Fuel cell** power plants using liquid backup raw fuels. Nakayama, Takashi (Tokyo Shibaura Electric Co, Japan). Jpn. Kokai Tokkyo Koho JP 08222256 A2 **19960830** Heisei, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1995-26744 19950215.

AB The power plants have a ejector connected via a reformer and a converter to the anode side of **fuel cells** for mixing and supplying a regular raw **fuel-steam** mixt., an **air** blower connected to the cathode side of **fuel cells**, a means for monitoring the cut off of the regular fuel supply during an emergency, a tank storing a backup liq. raw fuel, a means for supplying the backup fuel from the tank, an emergency ejector for evapg. the liq. fuel and supplying the vapor, mixed with steam, to the reformer, and a means, operating under an emergency, to close a regular raw fuel supplying valve and to start evapg. the backup fuel and mixing it with steam and supplying the mixt. to the reformer.

IC ICM H01M008-04
ICS H01M008-06

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** power plant backup fuel

IT **Fuel cells**
(structure of **fuel cell** power plants using liq. backup raw fuels)

L26 ANSWER 31 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN

1996:91968 Document No. 124:150887 **Fuel cell** power
plant with increased concentration of hydrogen in reformed fuel gas.
Akyoshi, Masahiro; Ichiki, Tadaharu (Tokyo Shibaura Electric Co,
Japan). Jpn. Kokai Tokkyo Koho JP 07320762 A2 **19951208**
Heisei, 3 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP
1994-107063 19940520.

AB A **fuel cell** power plant comprises an internal-heating reformer, in which a reformed gas having high H concn. is produced in combustion of a **fuel** gas, **steam**, and **air** directly supplied to the reformer, and an external-heating reformer in which a reformed gas having high H concn. is produced by external non-catalytic heating of the fuel gas. A portion of the fuel gas is reformed in the internal-heating reformer and the remaining fuel gas is reformed in the external heating reformer. The flows of the reformed fuel gas are combined together before being supplied to a **fuel cell**. A reformed fuel gas having high H concn. is obtained by using a comparatively simple structure.

IC ICM H01M008-06
ICS H01M008-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** power plant hydrogen concn

IT **Fuel cells**
(power plant, with increased concn. of hydrogen in reformed fuel gas)

IT 1333-74-0, Hydrogen, uses
(**fuel cell** power plant with increased concn. of hydrogen in reformed fuel gas)

L26 ANSWER 32 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN

1995:438114 Document No. 122:192435 **Fuel cell**
power plants using city gas as raw fuel. Tajima, Osamu; Oda,
Katsuya; Funabashi, Atsuhiro; Sakamoto, Shigeru (Sanyo Electric Co,
Japan). Jpn. Kokai Tokkyo Koho JP 06333588 A2 **19941202**
Heisei, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP
1993-118571 19930520.

AB The power plants have H/**air** (O) **fuel cells**, a **steam** boiler heated by the waste heat from the **fuel cells**, a pump for pressurizing a city gas, and a reformer to generate H from the pressurized city gas and the steam from the boiler.

IC ICM H01M008-06

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST city gas **fuel cell** power plant

IT **Fuel cells**
(**fuel cell** power plants using city gas as raw fuel)

L26 ANSWER 33 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1994:222446 Document No. 120:222446 Heat and power co-generation systems and buildings with the systems. Kamimura, Hiroshi; Tagawa, Hisato; Karasawa, Hidetoshi; Sumida, Isao; Sato, Takao (Hitachi Ltd, Japan). Jpn. Kokai Tokkyo Koho JP 06013093 A2 **19940121** Heisei, 8 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1992-170737 19920629.

AB The systems include a reformer for producing H from a raw **fuel** and **steam**, H/**air fuel cells** producing electricity, a boiler for producing steam, a means for supplying the steam to the reformer, a means for supplying water from the boiler as coolant to the **fuel cells**, a means for supplying the hot combustion gas from the reformer as combustion air to the boiler, and means for withdrawing heat from the steam. The cooling water exited from the **fuel cells** may be recovered for supplying to the boiler, the cathode off-gas may be also supplied to the boiler for combustion, the raw fuel may also be supplied to the burner of the reformer as fuel, and the anode off-gas may be supplied to the boiler as fuel.

IC ICM H01M008-04
ICS H01M008-00

ICA E04H001-06

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 47

ST **fuel cell** heat electricity generation

IT Heat
(co-generation of electricity and, **fuel cell**-boiler systems for)

IT **Fuel cells**
(power plants, in systems for co-generation of heat and electricity)

L26 ANSWER 34 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1992:616287 Document No. 117:216287 Operation of solid-electrolyte **fuel cells.** Itsuhonmatsu, Masamichi; Hirano, Hikari; Sasaki, Hiroichi (Osaka Gas Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 04190570 A2 **19920708** Heisei, 9 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1990-320265 19901122.

AB The **fuel cells** having successive cathode, electrolyte, and anode layers on a porous support, which may be the cathode itself, are supplied with an O-enriched **air** for their cathode and **steam**-reformed **fuel** gas from hydrocarbons for their anodes for operation. The fuel gas is recycled through the anodes with the utilization controlled at 10-20% for each cycle.

IC ICM H01M008-04
ICS H01M008-12

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST solid electrolyte **fuel cell** operation
IT **Fuel cells**
(solid-state, **fuel** gas-recycling, operation of)

L26 ANSWER 35 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1990:408945 Document No. 113:8945 Heaters for fuel reformers. Uchida, Hiroshi; Ota, Hirokuni; Oyanai, Hideo; Amano, Yoshiaki; Hanzawa, Akio (Tokyo Gas Co., Ltd., Japan; Hitachi, Ltd.; Hitachi Techno Engineering K. K.). Jpn. Kokai Tokkyo Koho JP 01282101 A2 **19891114** Heisei, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1988-111503 19880510.
AB The heaters are composed of an annular fuel air header, and combustion catalysts placed around the inner surface of header. They are installed in catalytic fuel steam reformers for manuf. of H2-contg. gases from hydrocarbons or alcs. Stable combustion is carried out even under fluctuation of loads.
IC ICM C01B003-38
ICS F23K005-00
CC **49-1** (Industrial Inorganic Chemicals)
IT Heating systems and Heaters
(**fuel-air**, for catalytic **fuel steam** reformers)

L26 ANSWER 36 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1989:118200 Document No. 110:118200 High temperature proton conducting oxides and their applications to solid electrolyte **fuel cells** and steam electrolyzer for hydrogen production. Iwahara, H. (Fac. Eng., Tottori Univ., Tottori, 680, Japan). Solid State Ionics, Volume Date 1987, 28-30(Pt. 1), 573-8 (English) **1988**. CODEN: SSIOD3. ISSN: 0167-2738.
AB A review with 20 refs. of applications of H+ conducting SrCeO3-based ceramics as electrolytes. The properties of SrCeO3-based ceramics and uses in high-temp. **H-air fuel cells**, **steam** electrolysis for H manuf., and other applications (H purifn. gas detectors) are discussed.
CC 52-0 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 57, 72, 76
ST review strontium cerium oxide electrolyte; ceramic electrolyte proton conductive review; **fuel cell** ceramic electrolyte review; hydrogen manuf ceramic electrolyte review; electrolyzer hydrogen ceramic electrolyte review
IT Oxides, uses and miscellaneous
(proton-conducting, electrolytes, characteristics of, for **fuel cells** and steam electrolyzer for hydrogen prodn.)
IT **Fuel cells**
(solid-electrolyte, cerium strontium oxide ceramic electrolytes for)

L26 ANSWER 37 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1988:207730 Document No. 108:207730 Motten-carbonate **fuel cells**. Hado, Kazuhito; Niikura, Junji; Iwaki, Tsutomu (Matsushita Electric Industrial Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 63034860 A2 **19880215** Showa, 3 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1986-178035 19860729.

AB A Li titanate fiber-based sheet is sandwiched between electrolyte layers to form an electrolyte matrix for a molten-carbonate **fuel cell**. The sheet may contain a binder for shaping which is evapd. at the operation temp. of the cell. Thus, a sheet of 500-μ-long Li titanate fibers contg. 20% pulp was sandwiched between 2 cast tapes of a carbonate electrolyte-Li aluminate mixt. to form an electrolyte matrix for a **fuel cell** using Ni electrodes, a H-14 CO2-6% **steam fuel**, and an **air**-30% CO2 oxidant. After 10 cycles of operation at 650° for 1000 h and cooling to .apprx.20°, no cracks were obsd. on the matrix.

IC ICM H01M008-02

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST molten carbonate **fuel cell** electrolyte; lithium titanate fiber electrolyte matrix

IT **Fuel cells**
(molten-carbonate, electrolyte matrixes contg. sheets of lithium titanate fibers for)

IT 39302-37-9
(fibers, electrolyte matrixes contg. sheets of, for molten-carbonate **fuel cells**)

L26 ANSWER 38 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1988:170829 Document No. 108:170829 Cathodes for molten-carbonate **fuel cells**. Hado, Kazuhito; Gyoten, Hisaaki; Niikura, Junji; Iwaki, Tsutomu (Matsushita Electric Industrial Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 63002256 A2 **19880107** Showa, 3 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1986-146396 19860623.

AB Porous Ni-Cr alloys are used as the title cathodes without collectors. Thus, a Ni-Cr sheet was filled with Ni-Cr powder on 1 side and surface oxidized and doped with Li to form a cathode with the powder-filled side facing the K2CO3-Li2CO3 electrolyte layer in a **fuel cell** using a sintered Ni anode, a H-14 CO2-6% water (**steam**) **fuel**, and an **air** -30% CO2 oxidant. This cell showed almost no decrease in performance after a 10,000-h operation, whereas that of a cell using Ni cathode decreased sharply after several hundred hours.

IC ICM H01M004-86

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** cathode nickel chromium

IT Cathodes
(**fuel-cell**, nickel-chromium alloy)
IT 11105-45-6
(cathodes, for molten-carbonate **fuel cells**)

L26 ANSWER 39 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1988:170824 Document No. 108:170824 Anode for molten-carbonate **fuel cells.** Hado, Kazuhito; Gyoten, Hisaaki; Niikura, Junji; Iwaki, Tsutomu (Matsushita Electric Industrial Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 63002257 A2 **19880107** Showa, 3 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1986-146397 19860623.
AB Porous Ni-Cr alloys are used as the title anode without collectors. Thus, a porous Ni-Cr anode having Ni-Cr powder filled on its electrolyte side, a sintered Li-doped Ni anode, a Li2CO3-K2CO3 electrolyte, H-14 CO2-6% H2O (**steam**) **fuel**, and an **air**-30% CO2 oxidant were used in a **fuel cell.** This cell showed almost no decrease in performance after a 10,000-h operation, whereas that of a cell using a Ni anode decreased sharply after several hundred hours.
IC ICM H01M004-86
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST **fuel cell** anode nickel chromium
IT Anodes
(**fuel-cell**, nickel-chromium alloy)
IT 11105-45-6
(anodes, for molten-carbonate **fuel cells**)

L26 ANSWER 40 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1987:216951 Document No. 106:216951 Experimental and theoretical investigation into sulfate formation in the regeneration of zinc ferrite sorbents. Krishnan, G. N.; Tong, G. T.; Lamoreaux, R. H.; Brittain, R. D.; Wood, B. J. (SRI Int., Menlo Park, CA, USA). Report, DOE/MC/20092-2004; Order No. DE86001053, 105 pp. Avail. NTIS From: Energy Res. Abstr. 1986, 11(10), Abstr. No. 21853 (English) **1985.**
AB The regeneration of spent Zn ferrite sorbent for molten carbonate **fuel cells** using **air-steam** gas mixts. at 550 to 900° was studied. Thermodn. calcns. indicate and exptl. measurements confirm that ZnSO4 is formed in the regeneration process. The formation of the ZnSO4 requires the simultaneous presence of SO2 and O and reaches a max. level under conditions when the sulfides in the spent sorbent have been nearly oxidized. ZnSO4 formation is enhanced by low temps. and high O pressures in the feed gas. The formation of ZnSO4 is promoted by the presence of Fe oxide in the Zn ferrite and also by added Cr oxide. The analyses of residual sulfate present in sorbents regenerated in a lab. scale fixed-bed reactor were used to derive a

linear equation that predicts the sulfate level as a function of process variables. During subsequent desulfurization, the $ZnSO_4$ present in the regenerated sorbent releases SO_2 and SO_3 into the hot coal gas stream. These undesirable contaminants can be removed by another bed of Zn ferrite, provided that a sufficient concn. of H is available in the coal gas stream.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 51, 69

ST zinc ferrite sorbent **fuel cell**; **fuel cell** molten carbonate; sulfate zinc **fuel cell** sorbent; desulfurization zinc ferrite regeneration sulfate; coal gas desulfurization zinc ferrite

IT **Fuel cells**
(molten-carbonate, coal gas desulfurization for, zinc ferrite for, regeneration of)

IT Sorbents
(zinc ferrite, for coal gas desulfurization, for **fuel cells**, regeneration processes in)

IT Fuel gases
(coal gas, desulfurization of, zinc ferrite for, regeneration of, zinc sulfate formation in, for **fuel cells**)

IT 11129-48-9, Iron zinc oxide
(desulfurization sorbents of ferrite-type, for coal gases, for **fuel cells**)

IT 7733-02-0P, Zinc sulfate
(formation of, in zinc ferrite regeneration, coal gas desulfurization in relation to, for **fuel cells**
)

L26 ANSWER 41 OF 59 HCAPLUS

1987:123101 Document No. 106:123101 **Fuel cell** integrated with steam reformer. Beshty, Bahjat S.; Whelan, James A. (Engelhard Corp., USA). Eur. Pat. Appl. EP 206608 A2 **19861230**, 34 pp. DESIGNATED STATES: R: AT, BE, CH, DE, FR, GB, IT, LI, LU, NL, SE. (English). CODEN: EPXXDW. APPLICATION: EP 1986-304371 19860609. PRIORITY: US 1985-743204 19850610; US 1985-743714 19850610.

AB In a H-**air fuel cell** integrated with a **steam** reformer, a superheated H_2O-MeOH mixt. is fed to a catalytic reformer to provide a continuous supply of H to the cell, and the gases exhausted from the cell anode provide heat via combustion for superheating the H_2O-MeOH mixt. Thus, a superheated (to 900°F) H_2O-MeOH mixt. was passed at 14.7 psia and 1.5 g MeOH/g catalyst-h into an exptl. subscale reformer of a 1-in.-diam. pipe with a 1-ft-long conventional catalyst bed of 206 g ZnO/CuO catalyst on an Al_2O_3 support. The resp. MeOH conversions for the H_2O:MeOH molar feed ratios of 4.5 and 9.0 were 84.6 and 96.2%. The CO level in effluent samples of both runs was below the calibration

range of the gas chromatograph (100-200 ppm).
IC ICM H01M008-06
ICS C01B003-32
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST **fuel cell** integrated steam reformer; methanol steam conversion **fuel cell**
IT Steam
(conversion by, of superheated methanol, for hydrogen-air **fuel cells**)
IT **Fuel cells**
(hydrogen-air, with integrated steam reformer)
IT 67-56-1, Methanol, reactions
(conversion of superheated, with **steam**, for hydrogen-**air fuel cells**)
IT 7732-18-5
(steam, conversion by, of superheated methanol, for hydrogen-air **fuel cells**)

L26 ANSWER 42 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1986:210061 Document No. 104:210061 **Fuel-cell** power plant. Taguma, Toshiyuki; Yamada, Hiroko (Mitsubishi Electric Corp., Japan). Jpn. Kokai Tokkyo Koho JP 61034863 A2 **19860219** Showa, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1984-158005 19840726.
AB A power plant has a H-air **fuel cell**, a cooling water circulation loop using the heat generated at the **fuel cell** for producing **steam**, and an **air** compressor driven by a turbine using the produced steam and supplying compressed air to the **fuel-cell** cathode. The plant efficiently uses the **fuel-cell** waste heat.
IC ICM H01M008-04
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 48
ST hydrogen air **fuel cell**; **fuel cell** power plant; waste heat power plant
IT **Fuel cells**
(power plants, hydrogen-air, waste-heat use in efficient)
IT Heat
(waste, in **fuel-cell** power plants, efficient use of)

L26 ANSWER 43 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1985:28487 Document No. 102:28487 **Fuel-cell** power-generation systems. (Toshiba Corp., Japan). Jpn. Kokai Tokkyo Koho JP 59149667 A2 **19840827** Showa, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1983-21569 19830214.
AB The title systems are equipped with operating pressure monitor,

operating temp. monitor, emf. monitor, internal resistance monitor, and steam delivery system. Thus, a H3PO4 **fuel cell** was operated at 205° and 3.5 kg/cm2 with **air** contg. 3% **steam** and **fuel** contg. 10% **steam** at 60% and 80% cathode and anode utilization, resp. The cell had a long service life.

IC H01M008-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** phosphoric acid power

IT **Fuel cells**
(phosphoric-acid, power plants, with steam delivery system and of long service life)

1984:513967 Document No. 101:113967 **Fuel cells.** (Toshiba Corp., Japan). Jpn. Kokai Tokkyo Koho JP 59040471 A2 **19840306** Showa, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1982-149985 19820831.

AB **Fuel cells** use electrodes having interconnecting channels, wide ridges, and past-filled channels. Thus, C-fiber felts with channels on 1 side were treated with PTFE dispersion, and a Pt catalyst layer was formed on the flat side to prep. anodes. A porous graphite was treated with PTFE dispersion on 1 side and a Pt catalyst on the other side to prep. cathodes. A H3PO4 electrolyte in a SiC matrix was used. Each unit cell was sepd. by a phenolic resin-graphite composite. A **fuel cell** using H-CO2-**steam fuel** and **air** showed an output drop from 0.70 to 0.69 V in 5000-h operation vs. voltage drop from 0.58 to 0.35 V for a **fuel-cell** using conventional electrodes having regular channels.

IC H01M008-02; H01M004-86

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** phosphoric acid

IT **Fuel cells**
(phosphoric-acid, stable)

1984:457756 Document No. 101:57756 **Fuel cells** using acid electrolyte. (Toshiba Corp., Japan). Jpn. Kokai Tokkyo Koho JP 59040473 A2 **19840306** Showa, 5 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1982-149983 19820831.

AB The title cells use a H-based gas and an anode having channels with side openings and a U-turn flow barrier. A paste contg. electrolyte matrix and an electrolyte are filled in the channels. Thus, an anode was made from a C-fiber felt having channels with side openings. The channels were sepd. by U-turn flow barrier, and the inner faces of the channels and barriers were coated with PTFE. The flat side of the anode was coated with Pt-loaded activated C

catalyst. A SiC-H3PO4 paste was filled in channels and barriers. A cathode was prepd. with C fibers having channels and Pt-loaded activated C catalyst. A **fuel cell** using these unit cells had an output of 0.69-0.7 V for 5000-h operation vs. 0.35-0.58 V for a cell using unit cells having 2-side channeled electrode. The **fuel cells** used a H-15 CO2-10 mol% **steam fuel** and **air** oxidizer.

IC H01M008-02

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** phosphoric acid; hydrogen air **fuel cell**

IT **Fuel cells**
(hydrogen-air, phosphoric acid)

L26 ANSWER 46 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN

1984:457755 Document No. 101:57755 **Fuel cells.** (Toshiba Corp., Japan). Jpn. Kokai Tokkyo Koho JP 59040472 A2 **19840306** Showa, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1982-149987 19820831.

AB The title cells with H-based fuel consist of unit cells having an anode with channels on 1 side and a catalyst on the other side, an inorg. matrix impregnated with an acid electrolyte, and a porous C cathode with a catalyst on 1 side or dispersed in the electrode and PTFE on the other side. Thus, an anode was made from a 2.5-mm-thick C-fiber felt having 1.5 mm deep and 2 mm wide channels. The flat side of the anode was coated with Pt catalyst. A 0.4-mm-thick porous graphite sheet was used as a cathode which had a Pt-loaded C-powder layer on 1 side and a PTFE coating on the other side. A SiC-H3PO4 electrolyte matrix-electrolyte paste was used, and unit cells were sepd. by a grooved phenolic resin sheet. A fuel system using the unit cells had an output of 0.69-0.70 V for 5000-h operation vs. 0.35-0.60 V for a comparison **fuel cell.** The **fuel cells** used a H-15 CO2-10 mol% **steam fuel** and an **air** oxidizer.

IC H01M008-02; H01M004-86

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** phosphoric acid; hydrogen air **fuel cell**

IT **Fuel cells**
(hydrogen-air, phosphoric acid)

L26 ANSWER 47 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN

1984:213039 Document No. 100:213039 Temperature control of **fuel-cell** gases. (Mitsubishi Electric Corp., Japan). Jpn. Kokai Tokkyo Koho JP 59012573 A2 **19840123** Showa, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1982-120216 19820709.

AB The temp. of **fuel-cell** gases is controlled by

heat exchanging with steam to a desired temp. In an air
fuel cell, air is heat exchanged with steam and
the heated air is heat exchanged with fuel. The flow-rate control
of **steam** controls **air** and **fuel** temp.
Conventionally air and fuel are individually heat exchanged for
controlling their temp.

IC H01M008-04
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
ST **fuel cell** temp control
IT **Fuel cells**
(temp. control of gases in)

L26 ANSWER 48 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1984:142293 Document No. 100:142293 High-temperature sorbent method for removal of sulfur-containing gases from gaseous mixtures. Young, John E.; Jalan, Vinod M. (USA). U. S. Pat. Appl. US 395895 A0 **19831111**, 13 pp. Avail. NTIS Order No. PAT-APPL-6-395 895. (English). CODEN: XAXXAV. APPLICATION: US 1982-395895 19820707.

AB A CuO-ZnO mixt. is used as a sorbent for removing H2S and other S-contg. gases at high temps. from a gaseous fuel mixt. This high-temp. sorbent is esp. useful for prepg. fuel gases for high-temp. **fuel cells**. The CuO is initially reduced in a preconditioning step to Cu and is present in a highly dispersed state throughout the ZnO which serves as a support as well as adding to the S sorption capacity. The spent sorbent is regenerated by high-temp. treatment with an **air-fuel**, **air-steam** mixt. followed by H redn. to remove and recover the S. Thus, a simulated fuel gas contg. .apprx.200 ppm H2S by vol. was passed through a bed of sorbent pellets including 33 CuO and 67% ZnO. The sorbent was placed in contact with the gas until a breakthrough concn. of .apprx.10 ppm H2S appeared. The spent material was regenerated by air oxidn. at 650-750° followed by decompn. of sulfates in N at .apprx.750°. A S loading at least as great as obtained in the best runs with SiO2-supported Cu was obtained. Addnl. runs with the same but regenerated sorbent material were conducted with the addn. of a H redn. step. The greatest S loading (2.92-3.54%) was found in regeneration by contact with steam-air mixt. followed by H redn.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 59, 66
ST **fuel cell** gas sulfur removal; hydrogen sulfide removal fuel gas; copper oxide sorbent hydrogen sulfide; zinc oxide sorbent hydrogen sulfide
IT Absorbents
(copper oxide-zinc oxide, for sulfur-contg. gases in fuel gases for high-temp. **fuel cells**)

IT **Fuel cells**
(**fuel** gases for, removal of sulfur-contg. gases from, copper oxide-zinc oxide sorbent for)
IT Absorption
(of sulfur-contg. gases in fuel gases for high-temp. **fuel cells**, by copper oxide-zinc oxide mixt.)
IT 1314-13-2, uses and miscellaneous
(absorbents from copper oxide and, for sulfur-contg. gases in fuel gases for high-temp. **fuel cells**)
IT 1317-38-0, uses and miscellaneous
(absorbents from zinc oxide and, for sulfur-contg. gases in fuel gases for high-temp. **fuel cells**)
IT 7783-06-4, uses and miscellaneous
(removal of, copper oxide-zinc oxide absorbents for, in fuel gases for high-temp. **fuel cells**)

L26 ANSWER 49 OF 59 HCAPLUS
1984:141633 Document No. 100:141633 Automatically controlling synthesis gas production. Krasavtseva, G. M.; Kostyuk, N. V.; Sergeenko, A. O.; Trofimovich, S. I.; Patutin, A. N.; Petrov, V. A.; Antonov, V. I.; Stanin, V. P. ("Azot" Industrial Enterprises, Grodno, USSR). U.S.S.R. SU 1068383 A1 **19840123** From: Otkrytiya, Izobret., Prom. Obraztsy, Tovarnye Znaki 1984, (3), 65. (Russian). CODEN: URXXAF. APPLICATION: SU 1982-3491884 19820915.
AB The manuf. of gas for NH3 synthesis in an installation, including a heater, a CH4-converter with 1st and 2nd stages, removing CO by a 2-stage conversion, purifn., and methanation, is controlled by regulating the feed rates of **air**, **steam**, and **fuel** gas in the sep. conversion of CH4 in relation to the flow rate of the hydrocarbon mixt., the proportion of H and N in the fresh gas and the temp. at the outlet of the 2nd stage of CH4 conversion. The yield and quality of the target product are increased by improving the precision of the control by adjusting the flow rates of **air**, **steam**, and **fuel** gas with correction for the compn. of the hydrocarbon mixt., the fuel gas, and the flue gases, according to the concns. of CH4, CO, and CO2 after the conversion of CO at the 2nd stage, according to the concns. of CH4 and CO2 before the methanation and according to the temp. of the **steam**-gas mixt., the **fuel** gas and **air** at the inlet to the 1st conversion stage, and also according to the temp. of the steam-air mixt. at the inlet to the 2nd CH4 conversion stage.
IC C01B003-02; G05D027-00
CC **49-8** (Industrial Inorganic Chemicals)

L26 ANSWER 50 OF 59 HCAPLUS
1983:425463 Document No. 99:25463 Operation of **fuel-cell** power generation system. (Mitsui Toatsu Chemicals,

Inc., Japan). Jpn. Kokai Tokkyo Koho JP 58018881 A2
19830203 Showa, 6 pp. (Japanese). CODEN: JKXXAF.
APPLICATION: JP 1981-116374 19810727.

AB MeOH is steam reformed at ≤95% conversion to generate H for **fuel cells**, and the unreacted MeOH is collected in water for recycle.

IC H01M008-06; C01B003-32

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **fuel cell** power system

IT **Fuel cells**
(hydrogen-**air**, methanol **steam**-reforming, operation of power system of)

L26 ANSWER 51 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1983:129269 Document No. 98:129269 Air liquid-**fuel fuel cells.** (Nissan Motor Co., Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 57196479 A2 **19821202** Showa, 4 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1981-80469 19810527.

AB The title **fuel cells** with a water (reaction product) separator, consist of an anode chamber and an air cathode chamber, which are sepd. by an ion exchange membrane. The air cathode chamber is divided into an electrolyte compartment and an air compartment. A condenser is placed on the exit of each electrode chamber. Thus, in an **air**-MeOH **fuel cell**, the reaction product **steam** was condensed and removed from the system.

IC H01M008-04; H01M008-02

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST methanol air **fuel cell**; water removal **fuel cell**

IT **Fuel cells**
(methanol-air, with water-removal unit)

L26 ANSWER 52 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1981:518018 Document No. 95:118018 Development of the adiabatic reformer to process No. 2 fuel oil and coal-derived liquid fuels. Houghtby, W. E.; Buswell, R. F.; Bett, J. A. S.; Lesieur, R. R.; Meyer, A. P.; Preston, J. L.; Setzer, H. J. (Power Syst. Div., United Technol. Corp., South Windsor, CT, USA). Report, EPRI-EM-1701, 82 pp. Avail. NTIS From: Energy Res. Abstr. 1981, 6(10), Abstr. No. 14227 (English) **1981**.

AB **Fuel cell** power plants may be required to use coal derived liqs. or heavy petroleum distillates as fuels. The objective of this program is to develop the adiabatic reformer to process the heavier fuels. Testing was conducted primarily in a 2 in. diam., bench scale reactor. First, the configuration of the nozzle in which **fuel**, **steam** and **air** were mixed before entering the catalyst bed was optimized. Next,

holding the nozzle geometry const. the effect of variation of the catalyst was studied. A bench scale reactor incorporating the optimized nozzle and improved catalysts ran stably for 450 h. The performance met the goals for a 4.8 MW H3PO4 **fuel cell** power plant at a 9300 Btu/kWh heat rate for all conditions except operating pressure which was 45 psia. Two pilot scale, 6-in. diam. adiabatic reformers were built, each with a fuel-air mixing nozzle scaled-up from the best configuration identified in the bench scale reactors. The performance of the bench and pilot scale reactors (both filled with com. Ni catalyst) agreed within a nominal scatter which defined the ability to scale-up the design. Brief tests in the optimized bench scale reactor gave an assessment of the capability of the adiabatic reformer to process coal-derived liq. fuels. Systems studies evaluated the performance of alternate fuel processors, the hybrid, cyclic and thermal steam reformers relative to the performance of the optimized adiabatic reformer.

CC 51-9 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 52

IT **Fuel cells**
(power plants, **fuel** oil for, prodn. of, by adiabatic reformer)

IT Fuel oil
(prodn. of, by adiabatic reformers, for **fuel cell** power plants)

IT Petroleum refining
(reforming, of coal-derived liqs. and petroleum fraction, in prodn. of fuel oil, for **fuel cell** power plants)

L26 ANSWER 53 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN

1981:17870 Document No. 94:17870 Control of the loading of apparatus for two-step conversion of methane. Ermolenko, G. Z.; Nidchenko, N. A.; Lymareva, T. A. (USSR). U.S.S.R. SU 752271 **19800730** From: Otkrytiya, Izobret., Prom. Obraztsy, Tovarnye Znaki 1980, (28), 199. (Russian). CODEN: URXXAF. APPLICATION: SU 1978-2589789 19780313.

AB Title control is effected by changing the flow rates of natural gas, **steam**, **air**, and **fuel** gas entering the app. The precision of the process is increased by changing the flow rates of steam and air in relation to the flow rate of natural gas, the steam/natural gas flow rate ratio in relation to the load of the app., and establishing the flow rate of fuel gas in relation to the steam/natural gas flow rate ratios, the flow rate of air, and the assigned temp. of the converted gas.

IC G05D027-00; C01B002-02

CC **49-10** (Industrial Inorganic Chemicals)

L26 ANSWER 54 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1980:516935 Document No. 93:116935 Autothermal Reforming of No. 2 Fuel Oil. Houseman, J.; Voecks, G.; Shah, R. (Jet Propul. Lab., Pasadena, CA, USA). Report, EPRI-EM-1126, 106 pp. Avail. NTIS From: Energy Res. Abstr. 1980, 5(5), Abstr. No. 6653 (English) **1979.**

AB Expts. were conducted with a 4 + 15 in. catalytic reactor (Ni catalyst) to produce a H-rich gas from No. 2 **fuel** oil and **steam-air** mixts., at atm. pressure. The H yield was mapped in the carbon-free region as a function of the major operating parameters, particularly the steam-to-carbon and air-to-carbon ratios, and the preheat temp. The results are compared with the equil. yield predictions. Two optimum cases were identified. The 1st case represents a partial oxidn. process with air with just enough steam added to suppress carbon formation. In the 2nd case, 80% of the H was produced by partial oxidn. and 20% by steam reforming. A preheat temp. of 1400°F and a catalyst bed temp. of 2000°F was required to achieve the 2nd case results, at an air-to-carbon molar ratio of 1.9-2 and a steam-to-carbon molar ratio of 3.0%. The H yield translates to a 9500 Btu/kWh power plant heat rate at typical H3PO4 **fuel cell** operating conditions.

CC 51-9 (Fossil Fuels, Derivatives, and Related Products)
Section cross-reference(s): 52

L26 ANSWER 55 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1979:459525 Document No. 91:59525 Fluidized-bed system reactivates carbon. Anon. (USA). Chemical Engineering (New York, NY, United States), 86(13), 93-4 (English) **1979.** CODEN: CHEEA3. ISSN: 0009-2460.

AB A thermal regeneration process that incorporates a 3-step fluidization is described. Fluidization of the spent C is accomplished by upward-flowing gases, e.g., combusted **fuel**, **air**, and **steam**, that are introduced at the bottom of the regenerator refractory-lined, cyclindrical carbon steel shell. Spent granular C is reactivated with 50% less fuel and with less maintenance than multiple-hearth furnaces. The regenerated product has greater adsorption properties than new granular C.

CC **49-1** (Industrial Inorganic Chemicals)

L26 ANSWER 56 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1976:19873 Document No. 84:19873 Calcination of limestone to give highly active lime. Hayashi, Kiyoshi; Narita, Toshio; Tamura, Shoji (Ryoko Sekkai Sangyo K. K., Japan). Jpn. Kokai Tokkyo Koho JP 49130897 **19741214** Showa, 6 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1973-45289 19730421.

AB Highly active lime of uniform property is obtained by burning

auxiliary fuel dild. with steam at designated spots within the shaft furnace. In an internal combustion static type limestone calcination app. consisting of multiple shafts which are joined towards the bottom, as the combustion is allowed to take place in 1 of the shafts, the combustion gas flows parallel to the direction in which the solid is flowing (downward), and rises through the solid countercurrent to the solid flow in the 2nd connecting shaft; on subsequently carrying out the combustion in the 2nd shaft, the flow of the combustion gas is reversed. In such an app., a mixt. of an auxiliary fuel (5-15% of total fuel) and **steam** (30-120% of auxiliary **fuel**) is burned with **air** (**air** ratio <1.0). Thus, when limestone was calcined in a 2-shaft furnace using a steam/auxiliary fuel ratio of 0.8, an air ratio of 0.5, and 7% auxiliary fuel (percentage of total amt. of fuel), a product with uniform properties was obtained with degree of activation (titrn. of 50 g of 3-10 mm diam. sample with 4N HCl) 300 ml. In contrast, a conventionally prepd. material had highly scattered activity (60-280 ml) with an. av. value of 145 ml.

NCL 15F221

CC **49-3** (Industrial Inorganic Chemicals)

L26 ANSWER 57 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN

1975:566460 Document No. 83:166460 Apparatus and method for producing hydrogen-rich gas. Houseman, John (United States National Aeronautics and Space Administration, USA). Ger. Offen. DE 2439872 **19750703**, 22 pp. (German). CODEN: GWXXBX. APPLICATION: DE 1974-2439872 19740820.

AB A H-rich gas is produced with a low yield of free C by introducing a hydrocarbon fuel in a single combustion chamber, igniting the **fuel**, mixing **steam** and **air** with the hydrocarbon fuel within a single chamber, and removing the H-rich gas. Air is preheated, the water spray is injected into the stream of preheated air, and the steam-air mixt. is injected into the flame zone. The formation of C is prevented by maintaining a high steam concn. in the primary flame zone. The injection of steam into the primary flame zone also reduces the flame temp., thus preventing pyrolysis of the fuel.

IC C01B; F02M

CC **49-1** (Industrial Inorganic Chemicals)

L26 ANSWER 58 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN

1971:547183 Document No. 75:147183 Electrically coupled **fuel cell** and hydrogen generator. White, Donald W. (General Electric Co.). U.S. US 3607427 **19710921**, 5 pp. (English). CODEN: USXXAM. APPLICATION: US 1969-797144 19690206.

AB A solid O-ion electrolyte **fuel cell** elec. coupled directly to a solid O-ion electrolyte H2O-dissocn. cell (for H generation) is described. Hydrocarbon **fuel** is reacted

with **air, steam**, or **air** and steam to
produce a reducing gas mixt., which is admitted to the coupled cells
to depolarize the anode of the dissocn. cell and serve as fuel for
the **fuel cell**. The **fuel cell**
produces low voltage d.c. usable, as produced, by the dissocn. cell
and, when these cells are directly coupled elec., either cell will
automatically adjust to altered operating conditions or cell
characteristics of the other cell.

IC H01M
NCL 136086000
CC 77 (Electrochemistry)
ST **fuel cell** hydrogen generator; dissocn water
fuel cell
IT **Fuel cells**
(coupled to hydrogen generator)
IT 1333-74-0P, preparation
(by electrolysis, in **fuel cells**)

L26 ANSWER 59 OF 59 HCAPLUS COPYRIGHT 2004 ACS on STN
1970:489632 Document No. 73:89632 Submerged combustion carbonization.
Barnebey, Herbert L. (Barnebey-Cheney Co.). U.S. US 3525674
19700825, 10 pp. (English). CODEN: USXXAM. APPLICATION:
US 1966-552151 19660523.

AB In carbonizing flowable particles such as nut shells, pipes are
provided for feeding **air, steam**, or fluid
fuel into a combustion zone inside a pile of the material.
The kind and amts. of fluids fed into the combustion zone are
regulated so that the material passing through the zone is
completely carbonized and the combustible gases produced during
carbonization are completely burned within the pile. The process
can be carried out in an open pile, a vertical kiln, or a slowly
rotating horizontal drum. The product is suitable for making
activated charcoal.

IC C10B
NCL 201027000
CC **49** (Industrial Inorganic Chemicals)

=> d l37 1-26 max

L37 ANSWER 1 OF 26 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 2002-759626 [82] WPIX
DNN N2002-598172 DNC C2002-214638
TI Catalytic reactor, for fuel cell power **generating** system,
comprises reaction vessel containing reactant stream inlet, reactant
stream outlet and annular catalytic reactor tube with several
fluidly connected chambers.
DC H04 J04 L03 X16

IN GAO, Y
PA (GAOY-I) GAO Y; (BALL-N) BALLARD GENERATION SYSTEMS INC
CYC 100
PI US 2002132147 A1 20020919 (200282)* 9p H01M008-06
WO 2002075832 A2 20020926 (200282) EN H01M008-00
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZM ZW
W: AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CO CR CU CZ DE DK DM DZ EC EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ OM PH PL PT RO RU SD SE SG SI SK SL TJ TM TN TR TT TZ UA UG US UZ VN YU ZA ZM ZW
ADT US 2002132147 A1 US 2001-811086 20010316; WO 2002075832 A2 WO 2002-CA298 20020307
PRAI US 2001-811086 20010316
IC ICM H01M008-00; H01M008-06
ICS B01J008-04; **C01B003-26**
AB US2002132147 A UPAB: 20021220
NOVELTY - The catalytic reactor (5) comprises a reaction vessel (15) containing an annular catalytic reactor tube (40) with an interior volume divided into several fluidly connected chambers. The chamber(s) contains a catalyst **bed** (45). The vessel contains a reactant stream inlet (90) for directing a reactant stream to the chamber(s) and a reactant stream outlet (95) for directing a reactant stream from the chamber(s).

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for;

(1) A **fuel cell** power **generating** system comprises a **catalytic** reactor and a **fuel cell** stack. The catalytic reaction contains a reaction chamber (I) and a reaction chamber (II). The reaction chamber (I) comprises a catalyst **bed** for converting a reactant stream to a reformate stream (I) containing hydrogen. The reaction chamber (II) receives and converts the reformate stream (I) to a reformate stream (II) containing hydrogen. The fuel cell stack comprises at least one fuel cell fluidly connected to the catalytic reactor, such that the reformate stream (II) is directed to at least one fuel cell; and

(2) A fuel processing method, which involves supplying a reactant stream to the catalytic reactor and operating the system to obtain a reformate stream (II) containing hydrogen.

USE - For fuel cell power generating system (claimed), such as electrochemical fuel cells.

ADVANTAGE - The reactor tube permits increased mass flow rate for greater efficiency and reduced cost processing of hydrocarbon fuel for electrochemical fuel cells and other industrial applications. The reaction vessel provides homogeneous and faster reforming reaction and increases the amount of thermal energy transferred to the reactor tube per unit length. The septa reduces

variation in thermal expansion and contraction of the reactor tube, and hence decreases catalyst crush. The septa improves integration of the overall reactor structure, and facilitates **heat** conduction through the catalyst **beds**.

DESCRIPTION OF DRAWING(S) - The figure shows a vertical cross-sectional view of a catalytic reactor containing an annular cylindrical reactor tube comprising two reaction chambers.

Catalytic reactor 5
Burner 10
Reaction vessel 15
Gas sleeves 25
Inner wall 30
Outer wall 35
Annular catalytic reactor tube 40
Catalyst **bed** 45
Reactant stream inlet 90
Reactant stream outlet 95
Dwg.1/3

TECH US 2002132147 A1UPTX: 20021220

TECHNOLOGY FOCUS - MECHANICAL ENGINEERING - Preferred Apparatus: The interior volume contains an inner wall (30) and an outer wall (35) and at least two septa, preferably at least four septa extending from the inner wall to the outer wall to form at least two chambers, preferably at least four chambers. At least one of the septa, preferably at least three septa have an opening for effecting fluid connection between adjacent of the two chambers. The reactant stream is directed from the inlet through a chamber (I) in a direction (I), chamber (II) in a direction (II), chamber (III) in a direction (I), chamber (IV) in a direction (II) and then through the outlet. The direction (II) is the reverse of the direction (I). Each of the chambers comprises a catalyst **bed** and the catalyst **beds** of each chambers contain a different catalyst. The reactant stream comprises a hydrocarbon. The catalytic reactor further comprises a burner (10) for generating a combustion gas stream external to the reactor tube within the reaction vessel. The catalytic reaction further comprises an inner and outer burner gas sleeves (25) adjacent to the inner and outer walls, respectively, for directing the combustion gas stream in proximity to the inner and outer walls. The reaction chamber (I) is a catalytic **steam** reformer and the reaction chamber (II) is a catalytic water gas shift reactor. The catalytic reactor further comprises a reactant supply for supplying the reactant stream to the reaction chamber (I) via the inlet. The reactor further comprises an oxidant supply for supplying an oxidant to at least one of the reaction chambers (I,II). The fuel cell(s) is a solid polymer electrolyte fuel cell.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Stream: The

reactant stream comprises a fuel chosen from gasoline, diesel, natural gas, ethane, butane, light distillates, dimethyl ether methanol, ethanol, propane, naphtha and/or kerosene.
FS CPI EPI
FA AB; GI
MC CPI: H04-E06; H04-F02E; J04-E07; L03-E04; N06-D; N07-L03A
EPI: X16-C01

L37 ANSWER 2 OF 26 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 2002-599749 [64] WPIX
DNN N2002-475468 DNC C2002-169569
TI Hydrogen purification device for use in supplying hydrogen to solid polymer fuel cells e.g. in fuel cell power **generation** systems, has a carbon monoxide modification catalyst body.
DC E36 H04 L03 X16
IN FUJIWARA, S; TAGUCHI, K; TOMIZAWA, T; UKAI, K; WAKITA, H
PA (MATU) MATSUSHITA DENKI SANGYO KK; (FUJI-I) FUJIWARA S; (TAGU-I) TAGUCHI K; (TOMI-I) TOMIZAWA T; (UKAI-I) UKAI K; (WAKI-I) WAKITA H; (MATU) MATSUSHITA ELECTRIC IND CO LTD
CYC 24
PI WO 2002059038 A1 20020801 (200264)* JA 64p C01B003-48 <--
RW: AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE TR
W: CN KR US
JP 2002226204 A 20020814 (200268) 7p C01B003-48 <--
JP 2002348103 A 20021204 (200310) 7p C01B003-54 <--
JP 2002362904 A 20021218 (200312) 8p C01B003-48 <--
JP 2003073107 A 20030312 (200328) 9p C01B003-48 <--
US 2003175562 A1 20030918 (200362) H01M008-06
EP 1354853 A1 20031022 (200370) EN C01B003-48 <--
R: AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
CN 1457320 A 20031119 (200412) C01B003-48 <--
ADT WO 2002059038 A1 WO 2002-JP487 20020124; JP 2002226204 A JP 2001-18997 20010126; JP 2002348103 A JP 2001-156069 20010524; JP 2002362904 A JP 2001-176571 20010612; JP 2003073107 A JP 2002-86617 20020326; US 2003175562 A1 WO 2002-JP487 20020124, US 2003-239965 20030317; EP 1354853 A1 EP 2002-710339 20020124, WO 2002-JP487 20020124; CN 1457320 A CN 2002-800372 20020124
FDT EP 1354853 A1 Based on WO 2002059038
PRAI JP 2001-184479 20010619; JP 2001-18997 20010126; JP 2001-156069 20010524; JP 2001-176571 20010612
IC ICM **C01B003-48; C01B003-54**; H01M008-06
ICS B01J008-02; B01J023-42; B01J023-652; B01J023-656; B01J023-89; B01J029-068; B01J029-072; B01J029-12; B01J029-14; B01J029-16; B01J029-22; B01J029-44; B01J029-62; B01J029-74; B01J029-89; B01J029-90; B01J035-02; B01J037-08; B01J038-18; H01M008-04
ICA **C01B003-16**; H01M008-10
AB WO 200259038 A UPAB: 20021007
NOVELTY - Hydrogen purification device is equipped with a carbon

monoxide modification catalyst body (1) for removing carbon monoxide from a reformed gas containing hydrogen, carbon monoxide and **steam**, in which the catalyst body comprises a metal oxide containing at least one element selected from Fe, Cr, Ce, Mo, W, Re and Cu and one or more noble metals of Pt, Pd, Rh and Ru.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for a **fuel cell** power **generation** system using the **catalyst** body (1) to remove CO.

USE - The device is for use in supplying hydrogen to solid polymer fuel cells e.g. in fuel cell power generation system (claimed).

ADVANTAGE - The device can efficiently remove carbon monoxide (CO) in a reformed gas containing hydrogen, CO and **steam** so that highly pure hydrogen can be supplied for subsequent application.

DESCRIPTION OF DRAWING(S) - The drawing shows a longitudinal cross-sectional view of a hydrogen generation apparatus with the hydrogen purification device. (Drawing includes non-English language text).

catalyst body 1
reaction chamber 2
inlet for modified gas 3
modified gas outlet 4
dispersion plate 5
heat shielding material 6
Dwg.1/5

TECH WO 200259038 A1UPTX: 20021007
TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Device: The compound oxide is especially made by compounding not less than 1 of Mo, W, Re and Zr, in which the atom percentage ratio of Mo, W and/or Re in the compound oxide is higher than that of the noble metal. Such compound catalyst is in the form of a solid-fusion body. The catalyst body (1) is preferably ion-exchanged with or supported on:
(i) one or more elements of Fe, Cr, Ce, Re, Mo, W, Cu; and
(ii) at least one noble metal of Pt, Pd, Rh, Ru and a zeolite.
Alternatively the catalyst body (1) is preferably ion-exchanged with or supported on a mixture of the metal oxide or compound oxide containing one or more noble metals of Pt, Pd, Rh, Ru and zeolite. The zeolite is composed mainly of silica and alumina, with the SiO_2/Al_2O_3 ratio of not less than 4, which can be of Y type, L type, mordenite type, ZSM-5 type or beta type. The compound oxide is particularly made from Fe and Cr, Fe and Ni, or Fe, Cr and Ni. The metal oxide is preferably iron oxide, with particle diameter of 10 nm to 1 micrometer, which can contain Fe_2O_3 and/or Fe_3O_4 and has magnetism.

ABEX WO 200259038 A1UPTX: 20021007
EXAMPLE - A catalyst was obtained by supporting $Mo_{0.01}$ $Zr_{0.99}$ oxide and 0.5 mol.% Pt on e.g. zeolite. When a reformed gas was treated,

CO concentration in the purified hydrogen was 0.3 %. When tested at 400 degrees C, the methane concentration was 0.3 %.
KW [1] 97153-0-0-0 CL PRD; 783-0-0-0 CL REM; 0072-72501 CL; 0072-72502 CL; 0072-72503 CL
FS CPI EPI
FA AB; GI; DCN
MC CPI: E11-Q01; E11-Q02; E31-A02; E31-N05B; E34-E; E35; H04-E06; H04-F02E; L03-E04A2; N02-A01; N02-D01; N02-E01; N02-E02; N02-F; N03-A; N03-C02; N03-D; N03-E
EPI: X16-C01C; X16-C17
DRN 1423-U; 1532-P; 1532-U
CMC UPB 20021007
M3 *01* C101 C550 C810 M411 M424 M720 M740 M904 M905 N163 Q419 Q431 Q454
DCN: R01532-K; R01532-P
M3 *02* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M424 M740 M750 M781 M904 M905 M910 N163 Q419 Q431 Q454 Q508
DCN: R01423-K; R01423-R; R01423-X
M3 *03* A424 A426 A429 A542 A544 A545 A546 A674 A675 A678 A758 A940 C108 C730 C801 C802 C803 C804 C805 C807 M411 M424 M730 M740 M781 M904 M905 N163 Q419 Q431 Q454 Q508
DCN: 0072-72501-K; 0072-72501-C; 0072-72501-R
M3 *04* A424 A426 A428 A940 C108 C730 C801 C802 C803 C804 C805 C807 M411 M424 M730 M740 M781 M904 M905 N163 Q419 Q431 Q454 Q508
DCN: 0072-72502-K; 0072-72502-C; 0072-72502-R
M3 *05* A424 A426 A428 A940 C108 C730 C801 C802 C803 C804 C805 C807 M411 M424 M730 M740 M781 M904 M905 N163 Q419 Q431 Q454 Q508
DCN: 0072-72503-K; 0072-72503-C; 0072-72503-R

L37 ANSWER 3 OF 26 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 2002-084358 [12] WPIX
DNC C2002-025856
TI Fuel **reforming** apparatus for fuel cell, includes catalysts, fuel feeder, oxidizer feeders, oxidizer control valve, **steam** feeders, and master controller.
DC E36 H04 J04 L03
IN HANAWA, M; ICHIKAWA, H; YAMANASHI, F
PA (NSMO) NISSAN MOTOR CO LTD
CYC 28
PI EP 1160193 A1 20011205 (200212)* EN 21p C01B003-48 <--
R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI TR
US 2001047620 A1 20011206 (200212) C10J003-68
JP 2001348206 A 20011218 (200215) 20p C01B003-40 <--
ADT EP 1160193 A1 EP 2001-113313 20010531; US 2001047620 A1 US 2001-864230 20010525; JP 2001348206 A JP 2000-165098 20000601
PRAI JP 2000-165098 20000601
IC ICM **C01B003-40**; **C01B003-48**; C10J003-68

ICS **C01B003-32**; C10J001-00; H01M008-06

AB EP 1160193 A UPAB: 20020221

NOVELTY - A fuel reforming apparatus comprises two catalysts, a fuel feeder, two oxidizer feeders, an oxidizer control valve, **steam** feeders, and a master controller.

DETAILED DESCRIPTION - A fuel reforming apparatus comprises a first catalyst (1) with a support, for promoting a **steam** reforming reaction and a partial oxidation reaction; a second catalyst (2) with a support positioned upstream from the first catalyst, for promoting the partial oxidation reaction; a fuel feeder (3) for feeding a hydrocarbon as a fuel upstream from the second catalyst; a first oxidizer feeder (4) for feeding the oxidizer to the first catalyst; a second oxidizer feeder (5) for feeding the oxidizer to the second catalyst; an oxidizer control valve (6) for selectively supplying the oxidizer from an oxidizer source to one of the first and second oxidizer feeder; a first **steam** feeder (7) for feeding **steam** to the first catalyst; a second **steam** feeder (8) for feeding **steam** to the second catalyst; a **steam** controller for selectively supplying **steam** from a **steam** source to one of the feeder; and a master controller (10) for controlling the oxidizer controller and **steam** controller. The master controller has first and second states, to control the oxidizer controlling and **steam** controller in such a manner as to connect, in the first state, the oxidizer source to the second oxidizer feeder and the **steam** source to the first **steam** feeder, and in the second state, the oxidizer source to the first oxidizer feeder and the **steam** source to the second **steam** feeder. The master controller is in the first state during startup and transient operations and is in the second state during the other operations.

USE - For fuel cells.

ADVANTAGE - The fuel reforming apparatus is capable of quickly **heating** a catalyst to an activation temperature and shortening a start up time.

DESCRIPTION OF DRAWING(S) - The figure is a sectional view of the fuel reforming apparatus.

Catalysts 1, 2

Fuel feeder 3

Oxidizer feeders 4, 5

Oxidizer control valve 6

Steam feeders 7, 8

Master controller 10

Dwg.1/12

TECH EP 1160193 A1 UPTX: 20020221

TECHNOLOGY FOCUS - ELECTRICAL POWER AND ENERGY - Preferred Component: The master controller is switched to the second state after it is maintained in the first state for a predetermined

period. A temperature measuring unit measures a temperature of the first catalyst and sends an output to the master controller. The master controller is switched from the first state to the second state if the output from the temperature measuring unit is equal to a predetermined value.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Component: The hydrocarbon is methanol.

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Component: Each catalyst is a copper-based catalyst or a palladium-based catalyst. The second catalyst may be an oxidation catalyst.

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KW   [1] 97153-0-0-0 CL PRD; 70-0-0-0 CL; 71-0-0-0 CL; 15-0-0-0 CL
FS   CPI
FA   AB; GI; DCN
MC   CPI: E31-A02; H04-E04; H04-F02E; J04-E09; L03-E04; N02-D01; N02-F02
DRN  0270-S; 0270-U; 1532-P; 1532-U
CMC  UPB   20020221
     M3  *01* C101 C550 C810 M411 M424 M720 M740 M904 M905 N262 N441 Q413
              Q454 R013
              DCN: R01532-K; R01532-P
     M3  *02* A429 C810 M411 M424 M730 M740 M904 M905 Q421 Q507
              DCN: R05099-K; R05099-C
     M3  *03* A546 C810 M411 M424 M730 M740 M904 M905 Q421 Q507
              DCN: R03031-K; R03031-C
     M3  *04* H4   H401 H481 H8   M210 M211 M272 M281 M320 M416 M620 M730
              M904 M905 M910
              DCN: R00270-K; R00270-S

L37  ANSWER 4 OF 26  WPIX  COPYRIGHT 2004 THOMSON DERWENT on STN
AN   2002-000389 [01]   WPIX
DNN  N2002-000239       DNC C2002-000243
TI   High-efficiency catalytic steam reformer
     producing hydrogen for fuel cell from range of
     hydrocarbon fuels, cools shift reactor and purification unit with
     gases leaving fuel cell.
DC   E36 H04 H06 H08 L03 X16
IN   GRIESMEIER, U
PA   (XCEL-N) XCELLSIS GMBH; (GRIE-I) GRIESMEIER U
CYC  3
PI   DE 10010071    A1 20010913 (200201)*      6p     C01B003-48      <--
     FR 2805805     A1 20010907 (200201)              C01B003-48      <--
     US 2001028968  A1 20011011 (200201)              H01M008-06
     DE 10010071    C2 20020425 (200230)              C01B003-48      <--
ADT  DE 10010071 A1 DE 2000-10010071 20000302; FR 2805805 A1 FR 2001-2797
     20010301; US 2001028968 A1 US 2001-796711 20010302; DE 10010071 C2
     DE 2000-10010071 20000302
PRAI DE 2000-10010071 20000302
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IC ICM **C01B003-48**; H01M008-06

AB DE 10010071 A UPAB: 20020105

NOVELTY - A fuel cell is connected after the gas generator (1). Its anode chamber (9a) is supplied with hydrogen-rich gas from the generator. The cathode chamber (9b) is supplied with oxygen-containing gas. The cooling unit of the CO shift reactor (4) receives air flow leaving the cathode. The cooling unit of the gas purification unit (5a) is supplied with the gas flow leaving the anode.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for the method of starting up the equipment. When starting, the reformer reactor (2) is supplied with liquid fuel from the liquid fuel tank (10) and an oxygen-containing gas. Simultaneously the bypass line is opened. On completion of start-up, water is supplied to the reformer (2) and the bypass line (16) is closed. Preferred features: The gas generator has in addition a catalytic burner (6) for **heating** . It is supplied with gas leaving the anode and cathode, downstream of the cooling units. **Heat** exchangers (3, 8) transfer thermal energy from reformate gas leaving the reformer reactor (2), and/or from the catalytic burner, to an educt supplied to the reformer. An evaporator (8) is directly or indirectly heated by the catalytic burner, is supplied with a mixture containing liquid water and an oxygen-containing medium. A line supplies from the liquid fuel tank (10) to an evaporator (23) at least partially vaporizing it, before entry into the reformer. Further lines (18a, 18b, 19) supply oxygen-containing medium into the gas purification unit (5a, 5b) and/or the CO shift reactor (4). The bypass line (16) and valve (17) supply **reformate** gas to the **catalytic** burner, bypassing the **fuel cell.** During start up, oxygen-containing gas is additionally supplied to the CO shift reactor. Excess oxygen is supplied to the gas purification unit (5a, 5b) during start-up, beyond that required for selective oxidation of carbon monoxide.

USE - A gas generator producing hydrogen-rich gas by **steam** reforming, suitable for supply to fuel cells.

ADVANTAGE - Liquid fuels other than methanol, for which the infrastructure is not yet adequate, can be employed. The gas generator has high energy efficiency and the start up method proposed is rapid. Efficiency is improved by greater thermal integration, which makes maximum use of waste **heat.** Preheating gases from the fuel before entry into the catalytic burner, promotes high combustion temperature and high conversion of residual hydrocarbons, without having to raise the efficiency of the fuel cell. This is significant in a system with partial fuel oxidation. A cooling circuit for the CO shift reactor and the gas purification unit is obviated, making the system more compact and efficient.

DESCRIPTION OF DRAWING(S) - A block schematic flow diagram of

the system is presented.
gas generator 1
reformer reactor 2
heat exchanger 3
CO shift reactor 4
gas purification unit 5a, 5b
catalytic burner 6
anode chamber 9a
evaporator 8
cathode chamber 9b
liquid fuel tank 10
bypass line 16
bypass valve 17
lines supplying oxygen-containing medium 18a, 18b, 19
evaporator 23
Dwg.1/1

KW [1] 97153-0-0-0 CL PRD
FS CPI EPI
FA AB; GI; DCN
MC CPI: E11-S; E31-A02; H04-C02; H04-E06; H06-A; H08-E04; L03-E04
EPI: X16-C01A
DRN 1532-P; 1532-U
CMC UPB 20020105
M3 *01* C101 C550 C810 M411 M424 M720 M740 M904 M905 N105 N120 N163
N164 N513 N514 N515
DCN: R01532-K; R01532-P

L37 ANSWER 5 OF 26 WPIX
AN 2001-641941 [74] WPIX
DNN N2001-480096 DNC C2001-190175
TI Modifier used in fuel cell electricity **generation** system,
has **heat** exchanger between catalyst for **steam**
reforming hydrogen production and catalyst for carbon
monoxide reduction, and forms hydrogen.
DC E36 H04 H06 J04 L03 X16
PA (MITO) MITSUBISHI JUKOGYO KK
CYC 1
PI JP 2001220105 A 20010814 (200174)* 6p C01B003-38 <--
ADT JP 2001220105 A JP 2000-29329 20000207
PRAI JP 2000-29329 20000207
IC ICM **C01B003-38**
ICA H01M008-06
AB JP2001220105 A UPAB: 20011217
NOVELTY - A modifier which forms hydrogen by reacting liquid or
gaseous fuel with water vapor, has a **heat** exchanger for
cooling the formed gas between two types of catalysts. The two types
of catalysts are catalyst A for **steam** reforming hydrogen
production and catalyst B for carbon monoxide reduction, and are

provided in one container.
USE - Used in fuel cell electricity generation systems.
ADVANTAGE - A compact and lightweight modifier which avoids unnecessary **heating** when compared to conventional apparatus, is provided.
Dwg.0/7
TECH JP 2001220105 AUPTX: 20011217
TECHNOLOGY FOCUS - ELECTRICAL POWER AND ENERGY - Preferred Modifier: The modifier has two or more separately arranged catalysts (A,B). An air supply device is arranged near the raw material entrance side between the catalyst (A,B) and within one container. The air supply device is arranged just before the catalysts (A,B) and the **heat** exchanger is provided after each catalyst. The air supply device is arranged before the **heat** exchanger. The modifier is an integrated unit of catalyst A provided in a container A, **heat** exchanger, catalyst B provided in a container B, and air supply device.
KW [1] 97153-0-0-0 CL PRD; 783-0-0-0 CL REM; 3-0-0-0 CL
FS CPI EPI
FA AB; DCN
MC CPI: E11-Q02; E31-A02; E31-N05B; H04-E06; H06-A; J04-E02; L03-E04; N06; N06-D
EPI: X16-C17; X16-K
DRN 1423-U; 1532-P; 1532-U; 1740-S; 1740-U
CMC UPB 20011217
M3 *01* C101 C550 C810 M411 M424 M720 M740 M904 M905 N104 N120 N209 N262 N441
DCN: R01532-K; R01532-P
M3 *02* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M424 M740 M750 M904 M905 M910 N163 N441 Q431 Q436 Q439
DCN: R01423-K; R01423-X
M3 *03* C101 C108 C550 C730 C800 C801 C802 C804 C805 C807 M411 M730 M904 M905 M910
DCN: R01740-K; R01740-S

L37 ANSWER 6 OF 26 WPIX
AN 2001-556745 [62] WPIX
DNN N2001-413664 DNC C2001-165522
TI Start-up system for **generating** hydrogen from hydrocarbon feedstock in **fuel cell** comprises igniting feedstock, **reforming** effluent with **catalysts**, producing electric power and continuing ignition.
DC E36 H04 H06 L03 X16
IN DOSHI, K J; SENETAR, J J; TOWLER, G P; VANDEN BUSSCHE, K M
PA (UNVO) UOP LLC
CYC 1
PI US 6280864 B1 20010828 (200162)* 17p H01M008-04
ADT US 6280864 B1 US 1999-336084 19990618

PRAI US 1999-336084 19990618
IC ICM H01M008-04
ICS **C01B003-26**; H01M008-18
AB US 6280864 B UPAB: 20011026
NOVELTY - Generating hydrogen from hydrocarbon feedstock comprises igniting feedstock, reforming partial oxidation effluent stream, passing reforming effluent and water to water gas shift zone containing catalyst zones, passing crude hydrogen stream to anode of fuel cell and contacting cathode with oxygen stream to produce electric power, burning waste gas, passing flue gas to **heat** exchange zone, passing effluent to partial oxidation zone and continuing ignition.

DETAILED DESCRIPTION - Starting up a system for generating hydrogen from a hydrocarbon feedstock for a fuel cell comprises:

(a) passing a hydrocarbon (HC) feedstock and a **steam** stream to a pre-reforming zone and withdrawing a pre-reforming effluent stream;

(b) passing the pre-reforming effluent stream and a first air stream at a first air rate to a partial oxidation zone containing a partial oxidation catalyst;

(c) igniting the HC feedstock having a feedstock temperature to raise the feedstock temperature to effective partial oxidation conditions and to convert the HC feedstock to a partial oxidation effluent stream;

(d) passing the partial oxidation effluent stream to a reforming zone to produce a reforming effluent stream at a reforming exit temperature of 500-700 deg. C;

(e) passing the reforming effluent and a first water stream to a water gas shift zone containing water gas shift catalyst zone(s) in intimate contact with a water gas shift **heat** exchange zone to establish a steady-state temperature profile to produce a crude hydrogen product stream and simultaneously passing a second water stream to the water gas shift exchange zone to cool the water gas shift zone to provide a **steam** stream;

(f) passing the crude H2 product stream to a H2 processing module to provide a processed H2 stream;

(g) passing the processed H2 stream to an anode side of the fuel cell and contacting a cathode side of the fuel cell with an O2-containing stream to produce electric power and withdrawing an anode waste gas from the anode side;

(h) burning the anode waste gas admixed with a second air stream in a burner zone to produce a flue gas stream at a flue gas temperature of 500-700 deg. C;

(i) passing the flue gas stream to a pre-reforming **heat** exchange zone to establish a steady-state temperature profile to **heat** the pre-forming zone to an effective pre-forming temperature to convert (part of) the HC feedstock and a portion of the **steam** stream to provide a pre-reforming effluent at a

pre-reforming exit temperature; and

(j) passing the pre-reforming effluent to the partial oxidation zone and continuing the igniting step until effective partial oxidation conditions are achieved.

An INDEPENDENT CLAIM is included for a control system for a process to produce electric power from a HC feedstock.

USE - Used in hydrogen generation and fuel cell electric power generation operations, especially small-scale systems.

ADVANTAGE - Simplified control and lower temperatures allow for carbon steel and/or stainless steel construction. System is efficient, does not require external fuel and has high degree of feedstock flexibility at low cost.

DESCRIPTION OF DRAWING(S) - The figure shows a schematic block flow diagram illustrating core process.

Feedstock line Air stream 1
Water stream line 4
Hydrogen product stream line 6
Steam stream line 7
Anode waste gas line 8
Air stream line 9
Pre-reforming zone 11
Heat exchange zone 14
Water gas shift reaction zone 16
Heat exchange zone 18
Burner zone 20
Partial oxidation zone 22
Reaction zone 24
Reforming zone 26
Dwg.1/3

TECH US 6280864 B1 UPTX: 20011026

TECHNOLOGY FOCUS - CHEMICAL ENGINEERING - Preferred System: A control system is for measuring the reforming exit temperature, increasing or decreasing a first flow rate of the first air stream to achieve the reforming exit temperature at 500-700degreesC, measuring the flue gas temperature, and increasing or decreasing a second flow rate of the second air stream to **heat** the flue gas to a temperature of 500-800degreesC (500-700degreesC). Pre-reforming temperature is 300-700degreesC.

ABEX US 6280864 B1 UPTX: 20011026

EXAMPLE - A simulated system converted a natural gas stream at ambient temperature into electric power using a PEM fuel cell. The anode waste stream withdrawn from the fuel cell was the only source of fuel to heat the pre-reforming zone. The fuel processor was designed to produce 130 NL/mn hydrogen to be converted to 10 kW electricity from a fuel cell using 70% of the hydrogen per pass. Within the system, the exit temperature of the combined partial oxidation/reforming zone was maintained at 650degreesC and the temperature of the flue gas leaving the burner zone was maintained

at 650degreesC by controlling the rate of the first and second air streams passed to the partial oxidation/reforming zone and the burner zone, respectively.
KW [1] 97153-0-0-0 CL PRD; 217-0-0-0 CL
FS CPI EPI
FA AB; GI; DCN
MC CPI: E31-A02; E31-D02; H06-A; L03-E04
EPI: X16-C09; X16-C17
DRN 1532-P; 1532-U; 1779-U
CMC UPB 20011026
M3 *01* C101 C550 C810 M411 M424 M720 M740 M782 M904 M905 N104 Q413
Q417 Q454
DCN: R01532-K; R01532-M; R01532-P
M3 *02* C108 C550 C810 M411 M424 M740 M782 M904 M905 M910
DCN: R01779-K; R01779-M

L37 ANSWER 7 OF 26 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 2001-309681 [33] WPIX
DNN N2001-221683 DNC C2001-095827
TI Reactivating catalyst containing copper for oxidizing and/or **reforming** hydrocarbon, e.g. **generating** hydrogen in fuel cell vehicle, uses intermittent treatment with gas containing oxygen in monitored temperature range.
DC E36 H04 J04 L03 X16 X21
IN SALING, C; SCHUESSLER, M; STEFANOVSKI, T
PA (XCEL-N) XCELLSIS GMBH; (DBBF-N) DBB FUEL CELL ENGINES GMBH
CYC 27
PI EP 1084749 A2 20010321 (200133)* DE 6p B01J023-94
R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK
NL PT RO SE SI
DE 19944536 A1 20010329 (200133) B01J023-94
JP 2001137716 A 20010522 (200134) 5p B01J038-14
DE 19944536 C2 20020829 (200258) B01J023-94
US 6486087 B1 20021126 (200281) B01J038-12
ADT EP 1084749 A2 EP 2000-118333 20000824; DE 19944536 A1 DE 1999-19944536 19990917; JP 2001137716 A JP 2000-280783 20000914; DE 19944536 C2 DE 1999-19944536 19990917; US 6486087 B1 US 2000-664520 20000918
PRAI DE 1999-19944536 19990917
IC ICM B01J023-94; B01J038-12; B01J038-14
ICS B01J020-34; **C01B003-02; C01B003-22; C01B003-26; C01B003-32; C01B003-34; C01B003-36; C01B003-38;** C07C001-02; H01M008-06
AB EP 1084749 A UPAB: 20010615
NOVELTY - Periodic reactivation of catalyst material (I) containing copper, comprises treating with a gas stream (II) containing oxygen. Treatment is carried out intermittently at the reactor operating

temperature (Tr), with intervening cooling phases, and stopped at the latest when the monitored temperature of (I) exceeds a maximum at a predeterminable tolerance value above Tr.

DETAILED DESCRIPTION - In periodic reactivation of catalyst material (I) containing copper, which is used in catalytic oxidation and/or reforming of a hydrocarbon (derivative) charge and gradually deactivated by reaction, treatment with a gas stream (II) containing oxygen is carried out intermittently at the reactor operating temperature, at intervals separated by cooling phases, and stopped at the latest when the monitored temperature of (I) exceeds a maximum value at a predeterminable tolerance value above the operating temperature.

INDEPENDENT CLAIMS are also included for periodic reactivation of (I), especially in this way, in which : (a) ; (b)

USE - Catalyst (I) is useful e.g. in reactors for producing hydrogen in fuel cell vehicles by partial oxidation of methanol etc. and/or **steam** reforming.

ADVANTAGE - The process allows relatively simple and effective reactivation of (I) during normal operation, making it especially suitable for mobile use, e.g. in fuel cell vehicles, without significantly impairing the drive.

Dwg.0/0

TECH EP 1084749 A2 UPTX: 20010615

TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Process: In the reactor cold-start phase, fuel and a gas stream containing oxygen are passed over (I) until the monitored temperature of (I) exceeds a predeterminable switch-over value, before treatment with (II). To retain the **heat** content of the reactor, the (I) temperature is monitored continuously after operation and compared with a third, lower threshold and treatment with (II) is started at the latest when the temperature is below this value and stopped when the maximum is exceeded. Reactivation is restarted at the earliest when the monitored temperature of (I) is below a first threshold. (II) is an air stream diluted with **steam** and (I) is purged with **steam** before and/or after each treatment with (II). Reactivation in a reactor in a vehicle is started by detection of refueling or by the driver. The tolerance value is not more than100 K, preferably not more than20 K. In the cold start phase, the initial fuel-gas mixture contain a stoichiometric excess of oxygen and the stoichiometry can be changed during this phase. The switch-over temperature is 100-200, preferably about 150degreesC. The temperature of (I) is monitored and compared with a second lower threshold and reactivation is started directly by adding (II) when this threshold is exceeded.

KW [1] 97153-0-0-0 CL PRD; 70-0-0-0 CL; 15-0-0-0 CL; 217-0-0-0 CL USE

FS CPI EPI

FA AB; DCN

MC CPI: E11-Q01; E31-A02; E31-D02; H04-E06; H04-F02E; J04-E05; L03-E04;

L03-H05; N02-D01
EPI: X16-C17; X21-A01F; X21-B01A
DRN 0270-S; 0270-U; 1532-P; 1532-U; 1779-U
CMC UPB 20010615
M3 *01* C101 C550 C810 M411 M720 M904 M905 N120 N441 N513 Q417 Q454
DCN: R01532-K; R01532-P
M3 *02* A429 C810 M411 M730 M904 M905 Q421
DCN: R05099-K; R05099-C
M3 *03* H4 H401 H481 H8 M210 M211 M272 M281 M320 M416 M620 M730
M904 M905 M910
DCN: R00270-K; R00270-S
M3 *04* C108 C550 C810 M411 M781 M904 M905 M910 N164 Q508 R013
DCN: R01779-K; R01779-R; R01779-U

L37 ANSWER 8 OF 26 WPIX
AN 2001-071473 [08] WPIX
DNC C2001-020073
TI **Regeneration** of catalytic fuel processor, while in use to supply hydrogen to fuel cell, comprises continuing to pass **fuel**, **air** and **steam** though a **reforming** catalyst while **heating** catalyst with external **heat** source.
DC E17 H04 H06
IN BURCH, R; GOLUNSKI, S E; SOUTHWARD, B W L; WAILS, D
PA (JOHO) JOHNSON MATTHEY PLC
CYC 92
PI WO 2001000524 A1 20010104 (200108)* EN 15p C01B003-40 <--
RW: AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC
MW MZ NL OA PT SD SE SL SZ TZ UG ZW
W: AE AL AM AT AU AZ BA BB BG BR BY CA CH CN CR CU CZ DE DK DM
EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ
LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU
SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW
AU 2000056912 A 20010131 (200124) C01B003-40 <--
EP 1189833 A1 20020327 (200229) EN C01B003-40 <--
R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK
NL PT RO SE SI
EP 1189833 B1 20030129 (200309) EN C01B003-40 <--
R: AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
JP 2003503186 W 20030128 (200309) 20p B01J038-12
DE 60001318 E 20030306 (200325) C01B003-40 <--
ADT WO 2001000524 A1 WO 2000-GB2387 20000620; AU 2000056912 A AU 2000-56912 20000620; EP 1189833 A1 EP 2000-942203 20000620, WO 2000-GB2387 20000620; EP 1189833 B1 EP 2000-942203 20000620, WO 2000-GB2387 20000620; JP 2003503186 W WO 2000-GB2387 20000620, JP 2001-506944 20000620; DE 60001318 E DE 2000-601318 20000620, EP 2000-942203 20000620, WO 2000-GB2387 20000620
FDT AU 2000056912 A Based on WO 2001000524; EP 1189833 A1 Based on WO

2001000524; EP 1189833 B1 Based on WO 2001000524; JP 2003503186 W Based on WO 2001000524; DE 60001318 E Based on EP 1189833, Based on WO 2001000524

PRAI GB 1999-14662 19990624

IC ICM B01J038-12; **C01B003-40**
ICS B01J038-02; B01J038-04; B01J038-06; B01J038-52; **C01B003-32**; H01M008-06

AB WO 200100524 A UPAB: 20010207

NOVELTY - Regeneration of catalytic fuel processor comprises continuing to pass **fuel**, **air** and **steam** through a reforming catalyst:

(i) while the catalyst is heated by an external **heat** source;

(ii) while modulating the air and/or **steam** feed rate;

(iii) while modulating the feed-rate of the fuel; and

(iv) with additive added to the feed.

DETAILED DESCRIPTION - Regeneration of catalytic fuel processor, while in use to supply hydrogen to fuel cell, comprises:

(i) continuing to pass **fuel**, **air** and **steam** through a reforming catalyst while the catalyst is heated by an external **heat** source such that the temperature of the catalyst may be adjusted;

(ii) continuing to pass **fuel**, **air** and **steam** through a reforming catalyst and modulating the air and/or **steam** feed rate;

(iii) continuing to pass **air**, **fuel** and **steam** through a reforming catalyst and modulating the feed-rate of the fuel; and

(iv) continuing to pass **fuel**, **air** and **steam** through a reforming catalyst, with additive added to the feed.

The hydrogen concentration in dry reformate is maintained above 25% throughout the operation of the processor.

An INDEPENDENT CLAIM is also included, as above, for preventing or retarding the de-activation of a catalytic fuel processor while it is being used to supply hydrogen to a fuel cell.

USE - Regeneration of catalytic reactors, used e.g. in internal combustion engines, or in domestic co-generation of **heat** and power.

ADVANTAGE - Regeneration takes place while the processor is being used to supply hydrogen to a fuel cell, eliminating interruption of hydrogen generation.

Dwg.0/2

TECH WO 200100524 A1UPTX: 20010207

TECHNOLOGY FOCUS - CHEMICAL ENGINEERING - Preferred Process: Water is temporarily added to the fuel. Air is temporarily added to the feed. Additive, preferably an oxygenate, more preferably methyl-tert.-butylether, is added to the feed. The catalyst

bed temperature is raised temporarily by an external
heat source. The temperature of one or more of the reactant
feeds is raised temporarily.

KW [1] 783-0-0-0 CL REM; 102084-0-0-0 CL REM; 102109-0-0-0 CL REM;
102146-0-0-0 CL REM; 0030-97901 CL REM; 97153-0-0-0 CL USE

FS CPI

FA AB; DCN

MC CPI: E10-J02D; E11-Q02; E31-A03; E31-H01; E31-N05B; H04-E04;
H04-F02E; H06-A

DRN 1423-U; 1532-U; 1881-U; 1901-U; 1902-U

CMC UPB 20010207
M3 *01* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M750
M904 M905 M910 N164 N441 Q431 Q436 Q439
DCN: R01423-K; R01423-X
M3 *02* C107 C108 C520 C730 C800 C801 C802 C803 C804 C807 M411 M750
M904 M905 N164 N441 Q431 Q436 Q439
DCN: R01901-K; R01901-X
M3 *03* C108 C307 C520 C730 C800 C801 C802 C803 C804 C807 M411 M750
M904 M905 M910 N164 N441 Q431 Q436 Q439
DCN: R01902-K; R01902-X
M3 *04* C107 C108 C307 C520 C730 C800 C801 C802 C803 C804 C807 M411
M750 M904 M905 M910 N164 N441 Q431 Q436 Q439
DCN: R01881-K; R01881-X
M3 *05* M210 M211 M212 M213 M214 M215 M216 M220 M221 M222 M223 M224
M225 M226 M231 M232 M233 M320 M416 M610 M620 M750 M904 M905
N164 N441 Q431 Q436 Q439
DCN: 0030-97901-K; 0030-97901-X
M3 *06* C101 C550 C810 M411 M781 M904 M905 Q413
DCN: R01532-K; R01532-U

L37 ANSWER 9 OF 26 WPIX

AN 2000-376353 [32] WPIX

CR 2000-399657 [34]

DNC C2000-113783

TI Hydrocarbon fuel gas reformer for fuel cell power plants has
multiple catalyst tubes with a central regenerator tube and annular
catalyst bed in a thermally insulated housing.

DC E36 H04 J04 L03

IN BONK, S P; CORRIGAN, T J; FOLEY, P F; KOCUM, F A; SCHEFFLER, G W;
SEDERQUIST, R A; LESIEUR, R R; SETZER, H J

PA (ITFU) INT FUEL CELLS LLC; (ITFU) INT FUEL CELLS INC

CYC 82

PI WO 2000027518 A1 20000518 (200032)* EN 22p B01J008-04
RW: AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE
W: AL AM AT AU AZ BA BB BG BR BY CA CH CN CU CZ DE DK EE ES FI
GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR
LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI
SK SL TJ TM TR TT UA UG UZ VN YU ZW

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      AU 2000021486 A  20000529 (200041)              B01J008-04
      US 6258330    B1 20010710 (200141)              B01J035-02
      BR 9915190     A  20010814 (200154)              B01J008-04
      EP 1148939    A1 20011031 (200172)  EN          B01J008-04
          R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK
             NL PT RO SE SI
      KR 2001089430 A  20011006 (200220)              C10G075-00
      CN 1325319    A  20011205 (200223)              B01D050-00
      CN 1330570    A  20020109 (200229)              B01J008-04
      KR 2001110296 A  20011212 (200237)              B01J008-04
      JP 2002529895 W  20020910 (200274)      23p     H01M008-06
ADT   WO 2000027518 A1 WO 1999-US26885 19991110; AU 2000021486 A AU
      2000-21486 19991110; US 6258330 B1 US 1998-190855 19981110; BR
      9915190 A BR 1999-15190 19991110, WO 1999-US26885 19991110; EP
      1148939 A1 EP 1999-965796 19991110, WO 1999-US26885 19991110; KR
      2001089430 A KR 2001-705861 20010509; CN 1325319 A CN 1999-813115
      19991110; CN 1330570 A CN 1999-814465 19991110; KR 2001110296 A KR
      2001-705739 20010507; JP 2002529895 W WO 1999-US26885 19991110, JP
      2000-580738 19991110
FDT   AU 2000021486 A Based on WO 2000027518; BR 9915190 A Based on WO
      2000027518; EP 1148939 A1 Based on WO 2000027518; JP 2002529895 W
      Based on WO 2000027518
PRAI  US 1998-190855    19981110
IC    ICM  B01D050-00; B01J008-04; B01J035-02; C10G075-00; H01M008-06
      ICS  B01J010-00; C01B003-38; C01D001-00; C04B035-06;
           C09D001-02
AB    WO 200027518 A UPAB: 20021118
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NOVELTY - The reformer has a thermally insulated housing (12) enclosing multiple catalyst tubes (14) loaded with annular catalyst **beds** (72). Each catalyst tube encloses a central regenerator tube (50) which includes an inwardly tapered frustoconical portion (H2) for holding excessive amount of compacted catalyst in catalyst tubes and for providing a process gas flow channel minimizing catalyst **bed** fluidization.

DETAILED DESCRIPTION - The tapered portion of regenerator tube is covered by a perforated plate to allow gas to flow from catalyst **bed** to regenerator tube. The reformer housing includes a manifold for receiving process gas, formed between the bottom of housing and a primary plate conducting the weight of regenerator tube assembly connected to it to the side wall. A manifold receiving raw fuel gas opening into the catalyst **beds** is formed between the primary plate and a secondary plate conducting the weight of catalyst tube assembly to the side wall of housing.

USE - For producing hydrogen enriched fuel from raw fuel such as natural gas for fuel cell power plants.

ADVANTAGE - The provision of regenerator tubes with inwardly tapered fuel to conical portion allows for holding of excessive amount of catalyst and minimizing fluidization in catalyst

bed thus preventing excessive setting and crushing of catalyst leading to loss in height of catalyst **bed**. The catalyst is catalyst **bed** is compacted to maximize reformer performance. The tapered portions of regenerator tube provides a process gas flow channel, that reduces the fluidization of catalyst **bed**. The manifolds formed by plates conducting loads of catalyst tube assembly and regenerator tube assembly to side wall of housing provides an efficient supporting structure that keeps the tube bundles aligned and distributes loading forces evenly.

DESCRIPTION OF DRAWING(S) - The figure shows the fragmented cross-sectional view of reformer.

Housing 12

Catalyst tubes 14

Regenerator tube 50

Catalyst **bed** 72

Frustoconical portion of regenerator tube H2.

Dwg.2/5

KW [1] 97153-0-0-0 CL PRD; 7382-0-0-0 CL
FS CPI
FA AB; GI; DCN
MC CPI: E31-A02; H04-E06; H04-F02E; J04-E02; L03-E04; N06
DRN 0323-S; 0323-U; 1532-P; 1532-U
CMC UPB 20011126
M3 *01* C101 C550 C810 M411 M424 M720 M740 M904 M905 N209 N224 N441 N514 N515 Q417 Q454
DCN: R01532-K; R01532-P
M3 *02* M210 M211 M320 M416 M610 M620 M730 M904 M905 M910
DCN: R00323-K; R00323-S

L37 ANSWER 10 OF 26 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 2000-226496 [20] WPIX
DNN N2000-203519 DNC C2000-083072
TI System for removal of impurities from hydrogen gas used for fuel cells involves absorbing the impurities and then regenerating the absorbent by e.g. catalytic or application of reduced pressure.
DC E36 J01 J04 X16
IN HOOGERS, G
PA (JOHO) JOHNSON MATTHEY PLC
CYC 1
PI GB 2341561 A 20000322 (200020)* 21p B01D053-86
ADT GB 2341561 A GB 1998-20181 19980917
PRAI GB 1998-20181 19980917
IC ICM B01D053-86
ICS **C01B003-50**; H01M008-06
AB GB 2341561 A UPAB: 20000522
NOVELTY - The apparatus comprises a process chamber (3) for cleaning hydrogen gas. Impure gas is fed (1) into the chamber via a control valve (2) and detector. The detector measures any impurities in the

incoming stream and cuts off the feed and outlet (5) while the process chamber removes them.

USE - Removal of carbon monoxide from hydrogen gas streams (claimed) used to feed fuel cells. Other gases including hydrogen sulfide may also be removed.

ADVANTAGE - The apparatus avoids the need for the impurity removal to be part of the fuel cell thus simplifying the apparatus. The process does not require the continual injection of small amounts of oxygen into the anode of the cell thus degrading its performance.

DESCRIPTION OF DRAWING(S) - The drawing shows a schematic of a single chamber processing apparatus.

Impure hydrogen inlet 1
Purified hydrogen outlet 5
Absorption chamber 3
Absorbent 4
Oxidant gas feed 8
Outlet for removal of impurities 9
Control valves 2,6,7,10

Dwg.1A/2

TECH GB 2341561 A UPTX: 20001114
TECHNOLOGY FOCUS - CHEMICAL ENGINEERING - Preferred apparatus and process. The process chamber contains an absorbent (4), especially a charcoal or zeolite, that removes the impurities in the gas prior to cleaning. There may be more than one purification chamber so that one allows passage of purified hydrogen gas while the other one is closed off for removal of impurities. The detector may be an infrared, semiconductor, catalytic, electrochemical or a voltmeter. The cleaning of the absorbed impurities may be by a heterogeneous catalytic reaction, more preferably a catalytic oxidation process in which air or oxygen are introduced (8) to the chamber while it is isolated from the hydrogen gas stream by the control valves; an electrochemical reaction or a physical process, especially a vacuum system so the absorbed impurities may be released by a drop in pressure and removed via an exhaust. Valves (2,6) on the inlet (1) and outlet (5) regulate the flow of gas through the chamber(s). The purification chamber may be a single layer catalyst **bed** or may be incorporated into an electrochemical cell containing an anode, cathode and an electrolyte.

KW [1] 97153-0-0-0 CL PRD; 783-0-0-0 CL REM
FS CPI EPI
FA AB; GI; DCN
MC CPI: E11-Q01; E11-Q02; E31-A02; E31-F01B; E31-N04D; E31-N05B; E31-P02B; J01-E03C; J01-E03D; J01-E03F; J04-E02; N06
EPI: X16-C
DRN 1423-U; 1532-P; 1532-U
CMC UPB 20000522
M3 *01* C101 C550 C810 M411 M424 M720 M740 M904 M905 N164 Q431

DCN: R01532-K; R01532-P
M3 *02* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M750
M904 M905 M910 N164 Q431 Q436 Q439
DCN: R01423-K; R01423-X

L37 ANSWER 11 OF 26 WPIX
AN 2000-197400 [18] WPIX
DNC C2000-061329
TI Hydrogen **generator** for production of hydrogen for supply
to e.g. a **fuel cell**, comprises e.g.
reformer with **reforming catalyst** layer,
heating section, fuel supply section, water supply section
and shift reactor with shift catalyst layer.
DC E36 H06
IN HONDA, K; KITAGAWA, K; SHONO, T; TAGUCHI, K; TOMIZAWA, T; UKAI, K
PA (MATU) MATSUSHITA ELECTRIC IND CO LTD; (MATU) MATSUSHITA DENKI
SANGYO KK; (HOND-I) HONDA K; (KITA-I) KITAGAWA K; (SHON-I) SHONO T;
(TAGU-I) TAGUCHI K; (TOMI-I) TOMIZAWA T; (UKAI-I) UKAI K
CYC 27
PI EP 985635 A1 20000315 (200018)* EN 26p C01B003-48 <--
R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK
NL PT RO SE SI
JP 2000086203 A 20000328 (200026) 7p C01B003-38 <--
JP 2000119004 A 20000425 (200031) 8p C01B003-58 <--
JP 2000290001 A 20001017 (200056) 6p C01B003-38 <--
JP 2000302405 A 20001031 (200059) 6p C01B003-38 <--
US 2001002248 A1 20010531 (200131) C01B003-26 <--
US 6562088 B2 20030513 (200335) C01B003-00 <--
ADT EP 985635 A1 EP 1999-307162 19990909; JP 2000086203 A JP 1998-255001
19980909; JP 2000119004 A JP 1998-287649 19981009; JP 2000290001 A
JP 1999-98092 19990405; JP 2000302405 A JP 1999-113879 19990421; US
2001002248 A1 US 1999-392691 19990909; US 6562088 B2 US 1999-392691
19990909
PRAI JP 1999-113879 19990421; JP 1998-255001 19980909; JP 1998-287649
19981009; JP 1999-98092 19990405
IC ICM **C01B003-00; C01B003-26; C01B003-38**
; C01B003-48; C01B003-58
ICS H01M008-06
ICA H01M008-06
AB EP 985635 A UPAB: 20000412
NOVELTY - The hydrogen generator (1) operates such that, when the
amount of reformed gas supplied to a shift reactor (3) is increased,
the temperature of the downstream portion of the shift catalyst
layer (7) is raised to a higher temperature than the temperature
before the increase of the reformed gas. When the amount of the
reformed gas supplied to the shift reactor is decreased, the
temperature of the downstream portion of the shift catalyst layer is
lowered to a lower temperature than the temperature before the

decrease of the reformed gas.

DETAILED DESCRIPTION - The hydrogen generator (1) comprises a reformer (2) including a reforming catalyst layer for generating from a fuel a reformed gas containing hydrogen, a **heating** section for **heating** the catalyst layer, a fuel supply section for supplying fuel to the reformer and the **heating** section, a water supply section for supplying water to the reformer, a shift reactor (3) including a shift catalyst layer (7) for shifting carbon monoxide in the reformed gas to carbon dioxide by causing the reformed gas to react with water, and a temperature detector (9) for detecting the temperature of the downstream portion of the shift catalyst layer. The hydrogen generator operates such that, when the amount of reformed gas supplied to a shift reactor is increased, the temperature of the downstream portion of the shift catalyst layer is raised to a higher temperature than the temperature before the increase of the reformed gas. When the amount of the reformed gas supplied to the shift reactor is decreased, the temperature of the downstream portion of the shift catalyst layer is lowered to a lower temperature than the temperature before the decrease of the reformed gas.

USE - For the production of hydrogen for supply to e.g. a fuel cell.

ADVANTAGE - The hydrogen generator is capable of readily adjusting the hydrogen gas production amount by utilizing **heat** from the various reactions. The generator is capable of supplying a constant concentration hydrogen gas while keeping the concentration of byproduct carbon monoxide low, regardless of whether the production amount is large or small.

DESCRIPTION OF DRAWING(S) - The figure shows the hydrogen generator.

Hydrogen generator 1
Reformer 2
Shift reactor 3
Purifier 4
Shift catalyst layer 7
Temperature detector 9
Heat exchanger 10
Dwg.1/11

TECH EP 985635 A1 UPTX: 20000412

TECHNOLOGY FOCUS - CHEMICAL ENGINEERING - The generator further comprises a **heat** exchanger (10) downstream of the shift catalyst layer. The shift catalyst is cooled by passing through the **heat** exchanger fuel and/or water to be supplied to the reformed and air and/or fuel to be supplied to the **heating** section. The hydrogen generator further comprises a purifier (4), downstream of the shift reactor, for removing carbon dioxide from shifted gas released from the shift reactor by an oxidation reaction and/or a methanation reaction. An air supply section supplies air to

the shifted gas which is supplied to the purifier. The water supply section also supplies water to the shift reactor. The generator further comprises a first water vaporizer between the fuel supply section and the reformer, and a second water vaporizer between the reformer and the shift reactor. The water supply section additionally supplies water to the vaporizers, and **steam** generated from the first vaporizer is supplied to the reformer, and **steam** generated from the second vaporizer is supplied to the shift reactor. A device regulates the amount of water supply to the second vaporizer, and the temperature of the shift reactor is controlled by regulating the supply amount. A device controls the proportions of water supplied to the vaporizers, and the amount of water supply to the reformer and the shift reactor is maintained constant by controlling the supply proportions. A second **heat** exchanger is installed between the reformer and the shift reactor, for performing **heat** exchange between the reformed gas and fuel and/or water to be supplied to the reformer and air/or fuel to be supplied to the **heating** section. A third **heat** exchanger is installed between the shift reactor and the purifier, for performing **heat** exchange between the shifted gas and fuel and/or water to be supplied to the reformer, and air and/or fuel to be supplied to the **heating** section. The first **heat** exchanger includes a mixer inside the shift catalyst layer or downstream of the layer, for mixing the reformed gas with water. The mixer comprises a porous base or **heat** resistant fiber. The shift catalyst layer comprises a catalyst material supported on a base of honeycomb structure or a foamed structure having communicating pores. The shift catalyst layer includes a portion formed from a metallic base or a **heat** conducing ceramic base. The generator further comprises an oxidation preventing device on the upstream and/or downstream side of the shift catalyst layer, for preventing oxidation of the shift catalyst. The oxidation preventing device shuts off a passage between the reformer and the shift reactor and/or a passage between the shift reactor and the purifier. The oxidation preventing device comprises a metal oxide, which is reducible in the reformed gas and supported on a carrier of a honeycomb structure, a foamed structure having communicating pores or a mesh structure, or comprises fiber of the oxide. The oxidation preventing device includes a pressure controller for controlling the internal pressure of the shift reactor.

KW [1] 97153-0-0-0 CL PRD; 70-0-0-0 CL; 7382-0-0-0 CL
FS CPI
FA AB; GI; DCN
MC CPI: E31-A02; H06-A; N02-D01; N06
DRN 0323-S; 0323-U; 1532-P; 1532-U
CMC UPB 20000412
M3 *01* C101 C550 C810 M411 M424 M720 M740 M904 M905 N209 N224 N262

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            N441 N513 N514 Q413 R013
            DCN: R01532-K; R01532-P
     M3   *02* A429 C810 M411 M730 M904 M905 Q421
            DCN: R05099-K; R05099-C
     M3   *03* M210 M211 M320 M416 M610 M620 M730 M904 M905 M910
            DCN: R00323-K; R00323-S

L37  ANSWER 12 OF 26  WPIX  COPYRIGHT 2004 THOMSON DERWENT on STN
AN   2000-183968 [17]   WPIX
DNN  N2000-135733       DNC C2000-057879
TI   Reformer for endothermally and chemically converting a reactant to a
     reformate gas in fuel cells has a catalyst bed and a
     burner formed by a catalytically active layer.
DC   E36 H04 L03 X16
IN   FORMANSKI, V
PA   (OPEL) OPEL AG ADAM
CYC  1
PI   DE 19836289   A1 20000217 (200017)*      4p    C01B003-38      <--
ADT  DE 19836289 A1 DE 1998-19836289 19980811
PRAI DE 1998-19836289 19980811
IC   ICM  C01B003-38
     ICS  C01B003-26
AB   DE  19836289 A UPAB: 20000405
     NOVELTY - Reformer has a catalyst bed (2) and a burner
     formed by a catalytically active layer (1) with a first boundary
     surface (4) for the surrounding air and a second boundary surface
     (6) connected to the catalyst bed so that the reactant and
     the reformate gas can directly enter the layer (1). Heat transfer
     takes place at the same time over the second boundary surface.
          USE - For endothermally and chemically converting a reactant to
     a reformate gas in fuel cells.
          ADVANTAGE - Material introduction and removal is simplified,
          DESCRIPTION OF DRAWING(S) - The drawing shows a cross-section
     of the reformer.
          catalytically active layer 1
     catalyst bed 2
          first boundary surface 4
          second boundary surface 6
     Dwg.1/1
TECH DE 19836289 A1 UPTX: 20000405
     TECHNOLOGY FOCUS - INORGANIC CHEMISTRY - Preferred Reactor: The
     catalytically active layer (1) of the burner is made of porous
     material, the catalyst affecting oxidation being enclosed in pores
     of the burner. Layer (1) forms a support for the catalytic
     bed of the reformer.
KW   [1]  783-0-0-0 CL PRD; 97153-0-0-0 CL PRD; 3-0-0-0 CL; 7382-0-0-0 CL
FS   CPI EPI
FA   AB; GI; DCN
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MC CPI: E31-A01; H04-C02; H04-F02C; L03-E04; N06
EPI: X16-C17
DRN 0323-S; 0323-U; 1423-P; 1423-U; 1532-P; 1532-U; 1740-S; 1740-U
CMC UPB 20000405
M3 *01* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M720
M904 M905 M910 N120 N209 N224 N262 N441 N513 Q411 Q413 Q414
DCN: R01423-K; R01423-P
M3 *02* C101 C550 C810 M411 M720 M904 M905 N120 N209 N224 N262 N441
N513 Q411 Q413 Q414
DCN: R01532-K; R01532-P
M3 *03* C101 C108 C550 C730 C800 C801 C802 C804 C805 C807 M411 M730
M904 M905 M910
DCN: R01740-K; R01740-S
M3 *04* M210 M211 M320 M416 M610 M620 M730 M904 M905 M910
DCN: R00323-K; R00323-S

L37 ANSWER 13 OF 26 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 2000-064534 [06] WPIX
DNN N2000-050625 DNC C2000-018133
TI Compact, easily controlled methanol **reformer**, heated indirectly by catalytic oxidation and producing hydrogen for fuel cell powered vehicle.
DC E36 H04 J01 J04 L03 X16
IN WIELANG, S; WIELAND, S
PA (DBBF-N) DBB FUEL CELL ENGINES GMBH
CYC 25
PI EP 967005 A2 19991229 (200006)* DE 6p B01J008-02
R: AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK
NL PT RO SE SI
DE 19827879 C1 20000413 (200023) C01B003-32 <--
ADT EP 967005 A2 EP 1999-110073 19990522; DE 19827879 C1 DE
1998-19827879 19980623
PRAI DE 1998-19827879 19980623
IC ICM B01J008-02; **C01B003-32**
ICS B01J019-00; B01J019-24; **C01B003-50**; H01M008-06
AB EP 967005 A UPAB: 20000203
NOVELTY - A deflection chamber (4) interconnects the outlet end (1a) of the oxidation stage (1) to the inlet end (2a) of the reformer (2) stage.

DETAILED DESCRIPTION - Preferred features: A hydrogen separation membrane (6) is located on a side of the reformer stage other than the partition. Alternatively, it passes through the reformer stage in the form of hollow channel(s). A lance (12) passes through the oxidation stage, distributing oxidant gas into it. This lance (12) comprises a hollow ceramic fiber matrix. Water (e.g. **steam**) can be supplied at the inlet end (1b) of the oxidation stage and/or at the inlet of the reformer.

USE - A methanol reformer, e.g. producing hydrogen for a fuel

cell powered vehicle.
ADVANTAGE - A compact, low-weight, relatively inexpensive unit is formed. High hydrogen yield is achieved and hydrogen selectivity is increased. Because oxidation and reforming stages are separated, control becomes relatively simple. Controlling just the oxidant supply, will be seen to alter the ratio of oxidation to reforming rates. Autothermal operation is readily set up in this way.
DESCRIPTION OF DRAWING(S) - The reactor embodying oxidation and reforming stages, is seen in cross-section.
oxidation stage 1
outlet end of oxidation stage 1a
reformer stage 2
inlet end of reformer 2a
inlet end of oxidation stage 1b
hydrogen separation membrane 6
lance comprising hollow ceramic fiber matrix 12
Dwg.1/2

TECH EP 967005 A2 UPTX: 20000203
TECHNOLOGY FOCUS - CERAMICS AND GLASS - Preferred Apparatus: Oxygen is supplied through a hollow ceramic fiber matrix, possibly having catalytic activity. High temperature-resistant materials permeable to and non-permeable to hydrogen are present.
KW [1] 15-0-0-0 CL; 217-0-0-0 CL; 97153-0-0-0 CL PRD
FS CPI EPI
FA AB; GI; DCN
MC CPI: E31-A02; H04-E04; J01-E03E; L03-E04; N06
EPI: X16-C
DRN 0270-S; 0270-U; 1532-P; 1532-U; 1779-S; 1779-U
CMC UPB 20000203
M3 *01* C101 C550 C810 M411 M424 M720 M740 M904 M905 N105 N209 N224
N262 N411 N441 N513 N514 N515 Q413 Q431 Q434 Q454
DCN: R01532-K; R01532-P
M3 *02* H4 H401 H481 H8 M210 M211 M272 M281 M320 M416 M620 M730
M904 M905 M910
DCN: R00270-K; R00270-S
M3 *03* C108 C550 C810 M411 M730 M904 M905 M910
DCN: R01779-K; R01779-S

L37 ANSWER 14 OF 26 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 1998-071722 [07] WPIX
DNN N1998-057405 DNC C1998-024038
TI Fuel **reformer** for **fuel cell** -
comprises **reforming** cylinder, **catalyst** layer and
heating medium **generator**.
DC E36 J04 L03 X16
PA (FJIE) FUJI ELECTRIC CO LTD; (OSAG) OSAKA GAS CO LTD
CYC 1
PI JP 09309702 A 19971202 (199807)* 8p C01B003-38 <--

ADT JP 09309702 A JP 1996-126166 19960522
PRAI JP 1996-126166 19960522
IC ICM **C01B003-38**
ICS B01J008-02; B01J023-38; B01J023-755; H01M008-06
AB JP 09309702 A UPAB: 19980216
A fuel reformer for a **fuel cell** comprises a **reforming** cylinder, **catalyst** layer, and **heating** medium generator; the reforming cylinder consists of a vertical intermediate cylinder and inside and outside cylinders placed concentrically inside and outside the intermediate cylinder respectively and apart from it, and the inside and outside cylinders are connected each other with a top plate which is also connected to the intermediate cylinder and with a bottom plate which is apart from the end of the intermediate cylinder; the catalyst layer consists of a granular reforming catalyst packed at least in a ring-shaped space between the intermediate cylinder and the inside cylinder; the **heating** medium generator generates a **heating** medium for **heating** the catalyst layer and supplies the **heating** medium to at least the inside wall of the inside cylinder and the outside wall of the outside cylinder; a hydrocarbon fuel to which **steam** has been added is passed through the catalyst layer from a ri ng-shaped space between the intermediate cylinder and the outside cylinder and **steam** -reformed with the catalyst layer heated with the **heating** medium into a gas with high hydrogen content; and the fuel reformer is characterised in that the catalyst layer consists of both a noble metal type granular reforming catalyst and a nickel type granular reforming catalyst, the parts of the catalyst layer filled with the noble metal type granular reforming catalyst are located where the fuel is flowed in and where the reformed gas is flowed out, and the part of the catalyst layer filled with the nickel type granular reforming catalyst is located between the noble metal type granular catalyst layers.

ADVANTAGE - Squeezing of the granular reforming catalyst and deposition of carbon on the granular reforming catalyst are prevented. Also the fuel reformer can be made smaller and lighter and produced at low cost.
Dwg.0/4
FS CPI EPI
FA AB; DCN
MC CPI: E31-A01; J04-E02; L03-E04
EPI: X16-C17
DRN 1423-P; 1532-P
CMC UPB 19980323
M3 *01* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M424
M720 M740 M903 M904 M910 N441 Q454
DCN: R01423-P
M3 *02* C101 C550 C810 M411 M424 M720 M740 M903 M904 M910 N441 Q454

DCN: R01532-P

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L37  ANSWER 15 OF 26  WPIX  COPYRIGHT 2004 THOMSON DERWENT on STN
AN   1996-427367 [43]   WPIX
DNN  N1996-359818        DNC C1996-134673
TI   An internal reforming high temp. molten carbonate
     fuel cell - in which the steam
     reforming activity of the catalyst is reduced by
     adding passivating metal salts..
DC   L03 X16
IN   AASBERG-PEDERSEN, K; OLSEN, C; ROSTRUP-NIELSEN, J; AASBERG-PETERSEN,
     K; NIELSEN, J R
PA   (TOPS) HALDOR TOPSOE AS
CYC  15
PI   EP 734086      A1 19960925 (199643)* EN   10p    H01M008-06
         R: AT BE CH DE ES FR GB IT LI LU NL SE
     DK 9500283     A  19960921 (199650)              H01M008-06
     JP 08279362    A  19961022 (199701)         5p   H01M008-06
     US 5705288     A  19980106 (199808)         7p   H01M008-06
     EP 734086      B1 20000105 (200006)  EN          H01M008-06
         R: AT BE CH DE ES FR GB IT LI LU NL SE
     DE 69605961    E  20000210 (200015)              H01M008-06
     ES 2141987     T3 20000401 (200023)              H01M008-06
ADT  EP 734086 A1 EP 1996-104040 19960314; DK 9500283 A DK 1995-283
     19950320; JP 08279362 A JP 1996-61103 19960318; US 5705288 A US
     1996-619833 19960319; EP 734086 B1 EP 1996-104040 19960314; DE
     69605961 E DE 1996-605961 19960314, EP 1996-104040 19960314; ES
     2141987 T3 EP 1996-104040 19960314
FDT  DE 69605961 E Based on EP 734086; ES 2141987 T3 Based on EP 734086
PRAI DK 1995-283        19950320
REP  1.Jnl.Ref; EP 173904; EP 414573; GB 1179033; JP 61279067; US
     4774152; US 4894297; US 5348814
IC   ICM  H01M008-06
     ICS  B01J023-89; C01B003-40; C10L003-00
AB   EP    734086 A UPAB: 19961025
     A process for the generation of electrical energy in an internal
     reforming high-temp. fuel cell, comprises: (a) steam and /
     or CO2 reforming of a hydrocarbon feed gas in contact with a
     catalyst having activity in the steam-reforming of the
     carbonaceous gas to fuel gas and being arranged within the fuel cell
     in a heat-conducting relationship with electrochemical
     reactions proceeding in the cell; and (b) electrochemically reacting
     the fuel gas in an anode compartment of the cell for the generation
     of electrical energy, wherein the steam-reforming activity
     of the catalyst has been reduced by including in the catalyst one or
     more salts of metals selected from group IA, IIA, IVA and VA.
         USE - Used to produce electrical energy in a high-temp. fuel
     cell.
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ADVANTAGE - The internal reforming catalyst is passivated, thereby improving the temp. profile within the cell. Thus the cell lifetime is prolonged. Poisoning of the catalyst by alkaline cpds. has less of an impact on the passivated catalyst.
Dwg.0/4

ABEQ US 5705288 A UPAB: 19980223
A process for the generation of electrical energy in an internal reforming high-temp. fuel cell, comprises: (a) **steam** and / or CO2 reforming of a hydrocarbon feed gas in contact with a catalyst having activity in the **steam**-reforming of the carbonaceous gas to fuel gas and being arranged within the fuel cell in a **heat**-conducting relationship with electrochemical reactions proceeding in the cell; and (b) electrochemically reacting the fuel gas in an anode compartment of the cell for the generation of electrical energy, wherein the **steam**-reforming activity of the catalyst has been reduced by including in the catalyst one or more salts of metals selected from group IA, IIA, IVA and VA.
USE - Used to produce electrical energy in a high-temp. fuel cell.
ADVANTAGE - The internal reforming catalyst is passivated, thereby improving the temp. profile within the cell. Thus the cell lifetime is prolonged. Poisoning of the catalyst by alkaline cpds. has less of an impact on the passivated catalyst.
Dwg.0/4

FS CPI EPI
FA AB
MC CPI: L03-E04
EPI: X16-C02
DRN 1287-U; 1311-U; 1366-U; 1391-U; 1610-U

L37 ANSWER 16 OF 26 WPIX
AN 1996-379139 [38] WPIX
DNN N1996-319586 DNC C1996-119514
TI Small sized **reformer** for **fuel cell generators** - has fibrous nickel **reforming catalyst** filled in mixed gas flowing part preventing breakage by thermal expansion.
DC E36 J04 L03 X16
PA (OSAG) OSAKA GAS CO LTD
CYC 1
PI JP 08183603 A 19960716 (199638)* 10p C01B003-38 <--
ADT JP 08183603 A JP 1994-327262 19941228
PRAI JP 1994-327262 19941228
IC ICM **C01B003-38**
ICS B01J023-755; H01M008-06
AB JP 08183603 A UPAB: 19960924
Reformer for fuel cell generator, to reform feed gas supplied to a fuel cell generator (G), in which power is generated by

electrochemical reaction of fuel gas and oxygen-contg. gas to fuel gas, comprises a mixing part (40) to prepare mixed gas to be reformed by mixing **steam** with feed gas, and **heat** exchanging part (50) comprising an exhaust gas flowing part (50H) to flow exhaust gas of the fuel cell generator and mixed gas flowing part (50L) to flow mixed gas to be reformed exchanging the **heat** with the exhaust gas in the exhaust gas flowing part and to supply the mixed gas to the fuel cell generator. Fibrous Ni is filled in the mixed gas flowing part allowing the flow of mixed gas to be reformed to reform it to fuel gas.

USE - To reform feed gas supplied to a fuel cell generator to fuel gas.

ADVANTAGE - Because fibrous Ni as reforming catalyst filled in the mixed gas flowing part is not broken by thermal expansion or contraction, the durability of reformer is increased and small-sized reformers are mfd. at low cost.

Dwg.1/11

FS CPI EPI
FA AB; GI; DCN
MC CPI: E31-A02; J03-A; L03-E04; N02-C01
    EPI: X16-C01
DRN 0323-S; 1423-P; 1532-P; 1740-S
CMC UPB 19961205
    M3 *01* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M424
            M720 M740 M903 M904 M910 N120 N209 N212 N224 N262 N441 N513
            N514 N515 Q454
            DCN: R01423-P
    M3 *02* C101 C550 C810 M411 M424 M720 M740 M903 M904 M910 N120 N209
            N212 N224 N262 N441 N513 N514 N515 Q454
            DCN: R01532-P
    M3 *03* A428 C810 M411 M730 M903 Q421

L37 ANSWER 17 OF 26 WPIX
AN 1995-289997 [38] WPIX
DNN N1995-219685 DNC C1995-130217
TI **Heat** transfer in **reformers** for **reformed** gas prodn. for fuel cells - by feeding natural gas and **steam** to **reformer** with bayonet-type duplex catalyst pipe contg. air-permeable ceramic solid.
DC E36 H04 J04 X16
PA (CHIY) CHIYODA CORP
CYC 1
PI JP 07187603 A 19950725 (199538)* 5p C01B003-38 <--
ADT JP 07187603 A JP 1993-334674 19931228
PRAI JP 1993-334674 19931228
IC ICM **C01B003-38**
    ICS **C01B031-18**
AB JP 07187603 A UPAB: 19950927

In the prodn. of reformed gas for fuel cells composed of H2 and CO by feeding natural gas and **steam** to a reformer with bayonet-type duplex catalyst pipe, an air-permeable ceramic solid is placed in the inner pipe of the catalyst pipe. Also claimed is a **heat** exchange type reformer with bayonet-type duplex catalyst pipes placed in a can.

USE - Used in the prodn. of reformed gases for fuel cells.

ADVANTAGE - Since the air-permeable solid accumulates **heat** from the high temp. reformed gas and radiates the **heat** to the inner pipe walls, **heat** transfer from the reformed gas to the raw material gas is accelerated and the thermal energy of reformed gas is used effectively in a reforming reaction.

Dwg.2/2

FS CPI EPI
FA AB; GI; DCN
MC CPI: E31-A01; E31-P05A; E31-P06C; E34-C02; E35-L; H04-C02; J04-E01
EPI: X16-C
DRN 1247-U; 1423-P; 1423-S; 1521-U; 1532-P; 1544-U; 1740-S
CMC UPB 19951211
M3 *01* C101 C550 C810 M411 M424 M720 M740 M903 M904 M910 N105 N209 N224 N441 Q413
DCN: R01532-P
M3 *02* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M424 M720 M740 M903 M904 M910 N105 N209 N224 N441 Q413
DCN: R01423-P
M3 *03* B114 B720 B740 B831 C106 C800 C802 C803 C805 C806 C807 M411 M781 M903 M904 M910 Q453
DCN: R01521-U; R01544-U
M3 *04* M781 M903 M904 Q453
DCN: R01247-U
M3 *05* A313 A940 B114 B701 B712 B720 B831 C108 C802 C803 C804 C805 C807 M411 M781 M903 M904 Q453
DCN: 9538-C5201-U

L37 ANSWER 18 OF 26 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 1993-277605 [35] WPIX
DNC C1993-123527
TI Catalyst for **steam reforming** having high activity and strength - comprises calcined material of main component of nickel metal and residue of compsn. contg. chromium oxide and/or lithium-chromite.
DC E36 J04 L03
PA (TOFU) TONEN CORP; (SEKI-N) ZH SEKIYU SANGYO KASSEIKA CENT
CYC 1
PI JP 05192574 A 19930803 (199335)* B01J023-86
ADT JP 05192574 A JP 1991-299524 19911021
PRAI JP 1991-299524 19911021

IC ICM B01J023-86
ICS **C01B003-40**; H01M008-06
AB JP 05192574 A UPAB: 19931119
A catalyst (M) for **steam**-reforming comprises a calcined material of main component of (N) a nickel metal and residual of (C) a compsn. containing chromium-oxide and/or lithium-chromite.
(N) nickel metal is most pref. metallic nickel; to which cobalt, iron, rhodium, etc. can be added in an amt. of less than 30 wt.% of the metals. Amt. of (N) nickel metal is pref. 55-90 wt.% based on (M). (C) compsn. is mixt. of chromium-oxide and/or lithium-chromite and normal supporting material for **steam** -reforming e.g. alumina, silica magnesia, etc. wherein amt. of the supporting material is pref. less than 30 wt.%.
USE/ADVANTAGE - A **catalyst** used for **steam-reforming**, partic. for melt carbonate **fuel-cell**, can be produced, wherein deterioration of the catalyst by adhering electrolyte of carbonate of alkali-metal can be remarkably decreased, giving a long life of the catalyst and use for inner **reforming fuel-cell**. The **catalyst** has a high activity, strength, durability, long life, a good thermal conductivity, giving effective utilising **heat** generated by reaction of the cell.
FS CPI
FA AB; DCN
MC CPI: E31-A01; J04-E04; L03-E04; N01-A; N02-C; N03-D
DRN 1423-P; 1532-P; 1933-S
CMC UPB 19940124
M3 *01* C101 C550 C810 M411 M720 M903 M904 M910 N441 N515 Q454
DCN: R01532-P
M3 *02* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M720
M903 M904 M910 N441 N515 Q454
DCN: R01423-P
M3 *03* A428 C810 M411 M730 M903 Q421
M3 *04* A103 A424 A940 A980 C108 C550 C730 M411 M730 M903 Q421

L37 ANSWER 19 OF 26 WPIX
AN 1990-234249 [31] WPIX
DNN N1990-181643 DNC C1990-101148
TI **Reforming** of fuels for fuel cells - by supplying to reaction tube of fuel **reformer** filled with **reforming** catalyst and **steam reformed** to hydrogen-enriched gas for fuel cells.
DC E36 H06 J04 L03 X16
PA (KAWJ) KAWASAKI HEAVY IND LTD
CYC 1
PI JP 02160603 A 19900620 (199031)*
JP 07033242 B2 19950412 (199519) 7p C01B003-40 <--
ADT JP 02160603 A JP 1988-317213 19881215; JP 07033242 B2 JP 1988-317213

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     19881215
FDT  JP 07033242 B2 Based on JP 02160603
PRAI JP 1988-317213     19881215
IC   B01J023-46; C01B003-40; H01M008-06
AB   JP  02160603 A UPAB: 19930928
     Reforming of fuels for fuel cells in which the raw material gases
     which are to be reformed and contain hydrocarbons as principal
     components are supplied to the reaction tube of a fuel reformer
     filled with a reforming catalyst and steam-reformed to
     H-enriched reformed gases for fuel cells.
     Heating externally the reforming catalyst
     layer of the reaction tube such that by adding O or air to the raw
     material gases at the entrance to the reforming catalyst layer so as
     to heat internally the reforming catalyst layer by partial
     oxidn. of the raw material hydrocarbons and using as reforming
     catalysts those in which Rh is supported on porous catalyst supports
     made of heat-resisting inorganic substances contg. as a
     principal component a single substance such as zirconium oxide,
     magnesium oxide, silicon oxide and aluminium oxide or their
     mixtures.
          USE/ADVANTAGE - The raw material gases contg. hydrocarbons as
     principal components can be steam-reformed to H-enriched
     gases for fuel cells efficiently by
     heating the reforming catalyst layer
     internally by partial oxidn. of hydrocarbons and using highly active
     Rh/ZrO2 catalysts at low temps. @
     1/7@
FS   CPI EPI
FA   AB; GI; DCN
MC   CPI: E31-A02; H04-E04; H04-E06; H04-F02E; H08-E04; J04-E01; L03-E04;
          N02-E
     EPI: X16-C
DRN  1532-P
CMC  UPB   19930924
     M3   *01* C101 C550 C810 M411 M720 M903 M904 M910 N209 N224 N441 Q413
               DCN: R01532-P
     M3   *02* A428 A545 C810 M411 M730 M903 Q421

L37  ANSWER 20 OF 26  WPIX  COPYRIGHT 2004 THOMSON DERWENT on STN
AN   1990-234248 [31]   WPIX
DNN  N1990-181642       DNC C1990-101147
TI   Reforming of fuels for fuel cells - involves steam
     reforming in presence of added oxygen or air.
DC   E36 H06 J04 L03 X16
PA   (KAWJ) KAWASAKI HEAVY IND LTD
CYC  1
PI   JP 02160602    A  19900620 (199031)*
     JP 07025521    B2 19950322 (199516)       4p    C01B003-38       <--
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ADT JP 02160602 A JP 1988-317214 19881215; JP 07025521 B2 JP 1988-317214
19881215
FDT JP 07025521 B2 Based on JP 02160602
PRAI JP 1988-317214 19881215
IC **C01B003-38**; H01M008-06
AB JP 02160602 A UPAB: 19930928
The raw material gases which are to be reformed and contain hydrocarbons as principal components are supplied to the reaction tube of a fuel reformer filled with a reforming catalyst, and reformed to hydrogen-enriched reformed gases for **fuel cells** by **heating** externally the **reforming catalyst** layer of the reaction tube. Method comprises adding oxygen or air to the raw material gases at the entrance to the reforming catalyst layer to **heat** internally the reforming catalyst layer by partial oxidn. of the raw material hydrocarbons and at the same time **heating** externally the reforming catalyst layer through catalytic combustion of low calorie gases which contain the off-gas from the fuel cells as principal components.
USE/ADVANTAGE - The low calorie offgas from the fuel cells can be combusted stably through catalytic combustion. **Heat** is supplemented internally by the partial oxidn. which takes place in the catalyst layer of the reaction tube.
1/1
FS CPI EPI
FA AB; GI; DCN
MC CPI: E31-A02; H04-E04; H04-E06; H04-F02E; H08-E04; J04-E01; L03-E04;
N06
EPI: X16-C; X16-E
DRN 1532-P; 1779-S
CMC UPB 19930924
M3 *01* C101 C550 C810 M411 M720 M903 M904 M910 N209 N224 N441 Q413
DCN: R01532-P
M3 *02* A545 A546 C810 M411 M730 M903 Q421

L37 ANSWER 21 OF 26 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 1990-168997 [22] WPIX
DNN N1990-131314 DNC C1990-073850
TI Fuel **reformer** of **fuel cell** - comprises parallel **reforming** tubes carrying **reforming catalyst** on inner face and combustion catalyst on outer face.
DC E36 H04 L03 X16
PA (FJIE) FUJI ELECTRIC MFG CO LTD
CYC 1
PI JP 02111601 A 19900424 (199022)*
ADT JP 02111601 A JP 1988-264313 19881020
PRAI JP 1988-264313 19881020

IC C01B003-38; H01M008-06
AB JP 02111601 A UPAB: 19930928
In the fuel reformer, hydrocarbon and alcohol such as natural gas and methanol are reacted with **steam**, and hydrogen-rich reformed gas is formed. The gas is supplied to a fuel cell. In the fuel reformer, reforming tubes are set parallel to each other in an outer box. Through the tubes, reforming raw material gas is passed and combustion gas passed through the outer box. The reforming tube carries reforming catalyst in its inner face, and carries combustion catalyst in its outer face. The combustion catalyst burns the fuel, so that **heat** for the reforming reaction is supplied.
In the case of natural gas, a nickel system reforming catalyst is carried on the inner side of the alumina tube and a combustion catalyst such as platinum or paradium is carried on the outer side of the tube.
USE/ADVANTAGE - There is no need of a burner and its combustion furnace, so the reformer can be made compact. Since a gas passage is formed with the reforming catalyst layer, the amt. of catalyst can be reduced.
0/5
FS CPI EPI
FA AB; GI; DCN
MC CPI: E31-A02; H04-C01; L03-E04; N02-C; N02-F02
EPI: X16-C
DRN 0270-S; 1423-P; 1532-P
CMC UPB 19930924
M3 *01* C101 C550 C810 M411 M424 M720 M903 M904 M910 N209 N224 N262 N441 Q417 Q454 R013
DCN: R01532-P
M3 *02* C106 C108 C550 C730 C800 C801 C802 C803 C805 C807 M411 M424 M720 M903 M904 M910 N209 N224 N262 N441 Q417 Q454 R013
DCN: R01423-P
M3 *03* A428 A546 A678 C810 M411 M730 M903 Q421

L37 ANSWER 22 OF 26 WPIX
AN 1989-255686 [35] WPIX
DNN N1989-195116 DNC C1989-113758
TI Fuel cell reformer tube heat transfer - utilises sleeves mounted on individual tubes which form helical gas flow paths.
DC H04 L03 Q73 Q78 X16
IN PARENTI, E K
PA (ITFU) INT FUEL CELLS CORP
CYC 12
PI US 4847051 A 19890711 (198935)* 5p
EP 334792 A 19890927 (198939) EN
R: CH DE ES FR GB IT LI NL
DK 8901369 A 19890922 (198949)
JP 02009439 A 19900112 (199008)

CA 1316979	C	19930427 (199322)			C01B003-38	<--
EP 334792	B1	19940511 (199419)	EN	7p	C01B003-38	<--
R: CH DE ES FR GB IT LI NL						
DE 68915197	E	19940616 (199425)			C01B003-38	<--
ES 2052054	T3	19940701 (199429)			C01B003-38	<--
JP 2712084	B2	19980210 (199811)		4p	B01J008-06	
DK 172516	B	19981109 (199851)			C01B003-38	<--

ADT US 4847051 A US 1988-170475 19880321; EP 334792 A EP 1989-630054 19890321; JP 02009439 A JP 1989-70276 19890322; CA 1316979 C CA 1989-594083 19890317; EP 334792 B1 EP 1989-630054 19890321; DE 68915197 E DE 1989-615197 19890321, EP 1989-630054 19890321; ES 2052054 T3 EP 1989-630054 19890321; JP 2712084 B2 JP 1989-70276 19890322; DK 172516 B DK 1989-1369 19890321

FDT DE 68915197 E Based on EP 334792; ES 2052054 T3 Based on EP 334792; JP 2712084 B2 Previous Publ. JP 02009439; DK 172516 B Previous Publ. DK 8901369

PRAI US 1988-170475 19880321

REP A3...9139; No-SR.Pub; US 2409304; US 4661323

IC B01J008-06; **C01B003-38**; F23K005-08; F28D007-10; F28D021-00; H01M008-22

ICM B01J008-06; **C01B003-38**

ICS B01J019-24; F23K005-08; F28D007-10; F28D021-00; H01M008-04; H01M008-06; H01M008-22

AB US 4847051 A UPAB: 19930923

The catalyst tube assembly comprises a cylindrical metal tube with a bore which contains the catalyst **bed**. A coaxial sleeve is fitted around the tube. A number of ribs are located between the tube and sleeve forming helical hot gas flow paths. The ribs have arcuate surfaces which form line contact with the exterior of the tube.

ADVANTAGE - Provides improved heat transfer to the catalyst tubes increasing the efficiency of the reformer by 5% to 10% of fixed flow rates, or the fuel flow rate can be increased by up to 50% at a fixed reformer efficiency. The assembly is inexpensive to produce easily assembled and produces a tight, yet flexible heat transfer zone.

ABEQ EP 334792 B UPAB: 19940627

A catalyst tube assembly for a **catalytic reformer** fuel processor in a **fuel cell** power plant, comprising: a cylindrical metal tube (2) adapted to contain a catalyst **bed** in its bore; a sleeve (8, 14) being spaced radially outwardly from said tube exterior; a plurality of ribs (4, 16) disposed between said tube 92) and sleeve (8, 14) for forming helical hot gas flow paths (6, 18) around the exterior of said tube (2), characterized by the fact that said ribs have arcuate surfaces providing line contact with the exterior of said tube (2); and said sleeve (8, 14) is formed from a metal sheet which is bent around said tube (2) and compressively tightened thereabout to form a tight

interfit between said sleeve (8, 14), ribs (4, 16) and tube (20, which interfit is not loosened by thermal expansion or contraction of said tube (2) or sleeve (8, 14) when the fuel processor is operated.
Dwg.6/7

FS CPI EPI GMPI
FA AB; GI
MC CPI: H04-E04; H08-E04; L03-E04
EPI: X16-C

L37 ANSWER 23 OF 26 WPIX COPYRIGHT 2004 THOMSON DERWENT on STN
AN 1989-095174 [13] WPIX
DNN N1989-072259 DNC C1989-042130
TI **Fuel cell reformer** with **catalytic** combustion and **reforming** reactors - has stacked plates, contg. the catalysts, which are sepd. by **heat** conductive partitions and positioned about a fuel dispenser.
DC E36 H04 J04 X16
IN KOGA, M; WATANABE, T
PA (ISHI) ISHIKAWAJIMA HARIMA JUKOGYO KK
CYC 14
PI EP 308976 A 19890329 (198913)* EN 9p
R: AT BE CH DE ES FR GB GR IT LI LU NL SE
US 5015444 A 19910514 (199122)
EP 308976 B 19920102 (199202)
R: DE GB IT NL
DE 3867399 G 19920213 (199208)
ADT EP 308976 A EP 1988-115740 19880923; US 5015444 A US 1988-243334 19880909
PRAI JP 1987-145404U 19870925
REP JP 62027305; JP 62160134; JP 62160135; JP 62160136
IC B01J008-02; **C01B003-34**
AB EP 308976 A UPAB: 19930923
Reformer has a plurality of main units, each of which has a combustor with catalyst and a reforming reactor with catalyst. The combustor is separated from the reforming reactor by a **heat** conductive partition. Fuel is supplied to each combustor through a dispersion plate forming part of an auxiliary unit sandwiched between each main unit. Main and auxiliary units contain passages for flow of raw gas, fuel, air, reformed gas and burnt gas, and are stacked together to form a single element.
USE/ADVANTAGE - The reformer is used to produce hydrogen from methane and **steam**. its porous fuel dispersion plates and **heat** conductive partitions enable combustion and reforming to take place at lower temps. than in conventional reformers.
0/5
ABEQ EP 308976 B UPAB: 19930923

A reformer including a reforming reactor in which a raw material gas undergoes a reforming reaction in the presence of a catalyst and fuel gas is burned so that the reforming reaction temperature may be maintained at a proper level, and the burnt gas may indirectly **heat** the raw material gas in the reforming reactor (16); characterised in that said reformer comprises: a plurality of main units (I), each main unit (I) including a combustor (20) filled with combustion catalyst (26) and a reforming reactor (16) filled with reforming catalyst (24) with a **heat** conductive partition wall (22) being sandwiched between the combustor (20) and the reforming reactor, (16); an auxiliary unit (II), including a distance plate (30) which has a vacant fuel chamber (28); and two porous plates (34) sandwiching the distance plate (30), the porous plates (34) serving as fuel distribution plates for uniformly supplying the fuel into each combustor (20) of each main unit (I), whereby the reforming reactors (16) of the main units (I) are equally heated, the combustors (20) of the main units (I) facing each other so as to sandwich the auxiliary unit (II) between the main units (I); an air passage (44, 50) for supplying air to said combustor (20); an exhaust passage (48, 54) for discharging the gas burned in said combustor (20); a fuel gas passage (36, 40) for supplying fuel gas for reforming to the reforming reactor (16); a gas discharge passage (42, 38) for discharging the gas which is reformed; and a fuel passage (46, 52) for supplying the fuel to said fuel chamber (28), all the passages (36, 38, 40, 42, 44, 46, 48, 50, 52, 54) being formed within the main and auxiliary units (I, II).

ABEQ US 5015444 A UPAB: 19930923

Plate-type reformer comprises a series of main units each including a combustor and a reforming reactor filled with respective catalysts with a **heat** conductive partition between the combustor and the reactor; and a auxiliary unit including a fuel plate which has a vacant fuel chamber, and two porous plates sandwiching the fuel plate.

Auxiliary unit is sandwiched between the combustors of the main units.

ADVANTAGE - Effective **heat** exchange.

FS CPI EPI
FA AB; DCN
MC CPI: E31-A02; H04-E04; H04-F02E; J04-E02; N06
EPI: X16-C
DRN 0323-S; 1532-P; 1740-S
CMC UPB 19930924
M3 *01* C101 C550 C810 M411 M424 M720 M740 M903 M904 M910 N209 N224
N441 N515 Q417
DCN: R01532-P

L37 ANSWER 24 OF 26 WPIX
AN 1988-067475 [10] WPIX

DNN N1988-051051 DNC C1988-030353
TI Appts. to reform fuel for fuel cell - has catalyst **bed** in reaction vessel to react evaporated fuel.
DC J04 L03 X16
PA (YAMA) YAMANOUCHI PHARM CO LTD
CYC 1
PI JP 63021203 A 19880128 (198810)* 3p
ADT JP 63021203 A JP 1986-164737 19860715
PRAI JP 1986-164737 19860715
IC **C01B003-38**; H01M008-06
AB JP 63021203 A UPAB: 19930923
Appts. comprises a catalyst **bed** in a reaction vessel to react the fuel evaporated by an evaporator, and gas collector to collect the gas reformed in the vessel integrated with the evaporator.
1/1
FS CPI EPI
FA AB; GI
MC CPI: J04-E02; L03-E04; N06-D
EPI: X16-C

L37 ANSWER 25 OF 26 WPIX
AN 1987-239207 [34] WPIX
DNC C1987-101099
TI **Reformer** for fuel cell **generators** - has reactor tubes filled with catalyst contg.. porous glass tubes with sub-micron micropore structure.
DC E36 H04 L03
PA (HITA) HITACHI LTD
CYC 1
PI JP 62162601 A 19870718 (198734)* 6p
ADT JP 62162601 A JP 1986-595 19860108
PRAI JP 1986-595 19860108
IC **C01B003-38**
AB JP 62162601 A UPAB: 19930922
The reformer has reactor tubes filled with catalyst and **heating** devices which **heat** the tubes, in which methanol or hydrocarbons react with **steam** and reform into a H2-rich gas. Porous glass tubes having a submicron micropores structure are embedded in the catalyst so as to remove H2 gas selectively from the prod. gas.

ADVANTAGE - The reaction can proceed smoothly at a lower temp., e.g., at 690 deg.C as opposed to 820 deg.C in conventional methods.

Specifically, a raw gas preheated at 350;450 deg.C is introduced into a catalyst layer heated at 670 deg.C; H2-rich gas is recovered through a porous glass hollow fibre module; H2-lean gas is discharged through an outlet tube, part of which is used as a fuel for burners. The module consists of 0.1-0.5 mm thick wall, 2-5 mm

outside dia., 1-3 m long porous glass hollow fibres having several
angstrom micropores.
0/3
FS CPI
FA AB; DCN
MC CPI: E31-A02; H04-E04; H05-X; L03-E04; N06
DRN 0270-S; 1423-P; 1532-P
CMC UPB 19930924
M3 *01* C101 C550 C810 M411 M424 M720 M740 M903 M904 M910 N209 N212
N224 N441 N514 N515 Q431
DCN: R01532-P
M3 *02* A313 A980 B105 C108 C730 M411 M730 M903 Q421

L37 ANSWER 26 OF 26 WPIX
AN 1986-340918 [52] WPIX
DNN N1986-254418 DNC C1986-147778
TI Hydrogen prodn. e.g. for **fuel cell** - by
catalytic steam reforming of superheated
water-methanol mixt..
DC E36 L03 X16
IN BESHTY, B S; WHELAN, J A
PA (ENGH) ENGELHARD MINERALS CORP; (USAT) US DEPT ENERGY
CYC 14
PI EP 206608 A 19861230 (198652)* EN 34p
R: AT BE CH DE FR GB IT LI LU NL SE
JP 61285675 A 19861216 (198704)
US 4670359 A 19870602 (198724)
CA 1270519 A 19900619 (199028)
US 4946667 A 19900807 (199034)
CA 1291319 C 19911029 (199151)
EP 206608 B1 19930908 (199336) EN 20p H01M008-06
R: AT BE CH DE FR GB IT LI LU NL SE
DE 3688990 G 19931014 (199342) H01M008-06
JP 07101614 B2 19951101 (199548) 12p H01M008-06
ADT EP 206608 A EP 1986-304371 19860609; JP 61285675 A JP 1986-132006
19860609; US 4670359 A US 1985-743714 19850610; US 4946667 A US
1988-191725 19880506; EP 206608 B1 EP 1986-304371 19860609; DE
3688990 G DE 1986-3688990 19860609, EP 1986-304371 19860609; JP
07101614 B2 JP 1986-132006 19860609
FDT DE 3688990 G Based on EP 206608; JP 07101614 B2 Based on JP 61285675
PRAI US 1985-743204 19850610; US 1985-743714 19850610
REP 2.Jnl.Ref; A3...8732; BE 657241; DE 2640456; EP 10779; EP 18700; FR
1553361; GB 2135295; US 3179500; US 3469944; US 4588659
IC **C01B003-32**; H01M008-06
AB EP 206608 A UPAB: 19930922
(A) A continuous hydrogen fuel supply is provided for a fuel cell
system by (a) passing a gaseous water/methanol mixt. to a
heat exchanger for superheating; (b) passing the superheated

mixt. into a catalytic reactor for endothermic reaction to form hydrogen; (c) directing the hydrogen to the fuel electrode of a fuel cell; (d) directing air into the oxygen electrode of the fuel cell for electricity prodn.; and (e) exhausting the gaseous effluent from the fuel electrode, burning the combustible portion of the effluent in a burner and feeding the burner exhaust to the **heat** exchanger.

(B) A hydrogen prodn. process comprises superheating a gaseous water/methanol mixt. to 700-1100 def.F and then feeding the mixt to a catalytic reactor to produce hydrogen, at least a major portion of the **heat** for catalytic reaction being extracted from the superheated mixt.

(C) Also claimed are (i) an integrated methanol **steam** reformer, combustion chamber and methanol superheater unit, and (ii) integrated appts. for hydrogen and electricity prodn.

ADVANTAGE - Hydrogen prodn. is effected in a thermally efficient **steam** reformer of reduced size and cost and which can be integrated with a fuel cell power system or used for hydrogen generation alone.

1/6

ABEQ US 4670359 A UPAB: 19930922

A continuous supply of hydrogen for a fuel cell is produced by passing a superheated mix of water and methanol to a catalyst **bed** contains a mix of zinc oxide and chromium oxide followed by a high activity **bed** of zinc oxide and copper oxide on an alumina support. The reaction temp. being 425-600 deg.C and the water/methanol ratio between 2 and 9.

After use in the fuel cell the waste gas stream is burnt and the resulting hot gases used to provide a major part of the energy needed to preheat the water/methanol mix.

USE/ADVANTAGE - The arrangement enhances the overall energy efficiency and cost effectiveness of the fuel cell system.

ABEQ US 4946667 A UPAB: 19930922

H2 is produced by A) as known catalytically reacting a gas mixt. of MeOH and water with B) the gas mixt. being heated to 371-593 deg.C. while the ratio water vapour:MeOH and the degree of superheat being maintained at such a level that the **heat** required for the endothermic reaction is extracted directly from the superheated gas mixt. The catalyst is pref. a mixt. of ZnO and CrO3 on alumina, esp. is a low activity catalyst contg. 40-60 wt.% Zn and 10-30 wt.% Cr. A high activity catalyst is esp. used in a 2nd section of the reactor consisting of ZnO and CuO on alumina. The mol. ratio water:MeOH is 1.0-10.0.

ADVANTAGE - An effective process using a thermally efficient reactor smaller and cheaper than known ones; the reactor can be integrated with a fuel cell power system.

ABEQ EP 206608 B UPAB: 19931122

A process for the production of hydrogen, said process comprising

passing a gaseous feed mixture consisting essentially of methanol and water into a catalytic reactor over a catalyst **bed**, the improvement comprising superheating the gaseous mixture to a temperature between 371 deg. and 593 deg. C (between 700 deg. and 1100 deg. F) while controlling both the ratio of water vapour to methanol in, and the degree of superheat of, the gaseous feed mixture such that upon feeding the superheated gaseous mixture to the catalytic reactor and contacting it with the catalyst **bed** contained therein to produce hydrogen by an endothermic reaction of water and methanol over the catalyst **bed**, at least a major portion of the **heat** for the catalytic reaction is extracted from the superheated gaseous mixture.
Dwg.1/6

FS CPI EPI
FA AB
MC CPI: E31-A02; L03-E04; N01-C02; N02-D01; N03-D; N03-F; N06-D
EPI: X16-C
DRN 0270-S; 1520-S; 1532-P; 1549-S; 1740-S; 1933-S
CMC UPB 19930924
M3 *01* C101 C550 C810 M411 M424 M720 M903 M910 N209 N224 N262 N441 N514 N515 Q010 Q413 Q454
M3 *02* A424 A429 A430 A940 C108 C550 C730 M411 M730 M903 Q421

=> d l39 ibib abs ind 1-15

L39 ANSWER 1 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 2003-282114 JAPIO
TITLE: STOPPING METHOD OF FUEL CELL POWER GENERATING DEVICE
INVENTOR: OGA SHUNSUKE
PATENT ASSIGNEE(S): FUJI ELECTRIC CO LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2003282114	A	20031003	Heisei	H01M008-04

APPLICATION INFORMATION
STN FORMAT: JP 2002-85430 20020326
ORIGINAL: JP2002085430 Heisei
PRIORITY APPLN. INFO.: JP 2002-85430 20020326
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2003

AN 2003-282114 JAPIO
AB PROBLEM TO BE SOLVED: To provide an economically preferable stopping method for a **fuel cell** power **generating** device preventing **catalyst** oxidation by conducting

rational purge preventing the intrusion of air in stopping the device.
SOLUTION: This stopping method for the fuel cell power generating device having a fuel cell 10 generating electricity based on electrochemical reaction of fuel gas obtained by **steam** reforming hydrocarbon base raw fuel gas and air acting as oxidizing agent gas; a fuel reformer 11; a CO transformer 12; a CO removing device 13; and a **steam** generator 14 generating **steam** for reforming is as follows: **Steam** is passed in flammable gas line in various apparatuses, the flammable gas is purged, and at the point when outlet temperature of a catalyst layer in the fuel reformer is dropped at a given temperature, raw fuel gas is introduced to purge the **steam** in the line, and then the inside of the line is shut off from the outside air.

IC ICM H01M008-04
ICS C01B003-38; C01B003-48; H01M008-06; H01M008-10

L39 ANSWER 2 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 2003-229163 JAPIO
TITLE: BACK-UP REFORMER FOR SOLID OXIDE FUEL CELL
INVENTOR: OGIWARA TAKASHI
PATENT ASSIGNEE(S): TOKYO GAS CO LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2003229163	A	20030815	Heisei	H01M008-06

APPLICATION INFORMATION
STN FORMAT: JP 2002-28849 20020205
ORIGINAL: JP2002028849 Heisei
PRIORITY APPLN. INFO.: JP 2002-28849 20020205
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2003

AN 2003-229163 JAPIO
AB PROBLEM TO BE SOLVED: To obtain a back-up reformer for a solid oxide fuel cell which eliminates carbon precipitation at piping or a fuel cell electrode of the solid oxide fuel cell by effectively eliminating hydrocarbons having more than two carbon atoms in a molecule from fuel to be guided into the solid oxide fuel cell.
SOLUTION: The back-up reformer for removing hydrocarbon with more than two carbon atoms in a molecule from the fuel guided into the solid oxide **fuel cell** filled with **reforming catalyst** by a **steam reforming** method is so made to eliminate hydrocarbons having more than two carbon atoms in a molecule from the fuel cell with the use of exhaust air of the fuel cell as a necessary heating source.

As the heating source, exhaust fuel and combustion gas of the both can also be utilized in addition to the exhaust air.

IC ICM H01M008-06
ICS H01M008-02; H01M008-04; H01M008-12

L39 ANSWER 3 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 2003-104707 JAPIO
TITLE: FUEL REFORMER AND ITS STOPPING METHOD
INVENTOR: TAKIMOTO HIDETOSHI; MIZUSAWA MINORU; FUKUCHI YASUHIKO; OKADA HIKARI
PATENT ASSIGNEE(S): HONDA MOTOR CO LTD
ISHIKAWAJIMA HARIMA HEAVY IND CO LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2003104707	A	20030409	Heisei	C01B003-32

APPLICATION INFORMATION
STN FORMAT: JP 2001-310876 20011009
ORIGINAL: JP2001310876 Heisei
PRIORITY APPLN. INFO.: JP 2001-227474 20010727
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2003

AN 2003-104707 JAPIO
AB PROBLEM TO BE SOLVED: To provide a fuel reformer able to exhaust and treat safely a residual fuel gas after stopping its operation without a particular equipment or utilities and to prevent poisoning a **reforming catalyst** and a **fuel cell** and easy to be compact for setting in car and its stopping method.
SOLUTION: The residual gas in a partial oxidation reformer 14 is exhausted while superheat of the catalyst is controlled by supplying intermittently air to stop fuel gas supply after stopping the operation to the partial oxidation reformer 14 in which a combustion/reforming catalyst 15 to reform the fuel gas to a reformed gas containing hydrogen by heat generation at the partial oxidation of the fuel gas containing **steam** is packed. As a three-way valve is changed to a catalytic combustor side and the exhausted residual gas pressure is adjusted by a gas pressure adjuster 17, abnormal combustion in the catalytic combustor is controlled.

IC ICM C01B003-32
ICS C01B003-38; H01M008-04; H01M008-06
ICA H01M008-10

L39 ANSWER 4 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 2002-319416 JAPIO
TITLE: HEAT AND POWER COMBINATION PLANT AND ITS OPERATING METHOD
INVENTOR: BAUMANN FRANK; WIELAND STEFAN; BRITZ PETER; HEIKRODT KLAUS
PATENT ASSIGNEE(S): OMG AG & CO KG
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2002319416	A	20021031	Heisei	H01M008-04

APPLICATION INFORMATION
STN FORMAT: JP 2002-98495 20020401
ORIGINAL: JP2002098495 Heisei
PRIORITY APPLN. INFO.: EP 2001-108230 20010331
PRIORITY APPLN. INFO.: EP 2001-130792 20011222
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 2002

AN 2002-319416 JAPIO
AB PROBLEM TO BE SOLVED: To provide a heat and power combination plant that has a combination gas generating system.
SOLUTION: This heat and power combination plant has a **steam** reformer (2) that is heated by a gas burner. This **steam** reformer converts a mixture of hydrocarbon and **steam** into a reformed gas flow containing hydrogen and carbon monoxide. The plant, further, has a reformer system (5, 6) having plural stages for removing carbon monoxide from the reformed gas flow. The plant further comprises a heat exchanger (4, 7) for taking out heat energy from the reformed gas flow and a **fuel cell** for **generating** electric energy by **catalytic** reaction of hydrogen and oxygen contained in the reformed gas.
COPYRIGHT: (C)2002,JPO
IC ICM H01M008-04
ICS C01B003-38; H01M008-06

L39 ANSWER 5 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 2001-279271 JAPIO
TITLE: METHOD FOR PRODUCING FUEL OIL FOR FUEL CELL AND HYDROGEN FOR FUEL CELL
INVENTOR: MATSUMOTO HIROTO; OSAWA MITSURU
PATENT ASSIGNEE(S): IDEMITSU KOSAN CO LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 2001279271	A	20011010	Heisei	C10L001-04

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APPLICATION INFORMATION
     STN FORMAT:            JP 2000-91496          20000329
     ORIGINAL:              JP2000091496           Heisei
PRIORITY APPLN. INFO.:      JP 2000-91496          20000329
SOURCE:                     PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined
                            Applications, Vol. 2001
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AN 2001-279271 JAPIO

AB PROBLEM TO BE SOLVED: To provide a method for producing a fuel oil for fuel cells capable of effectively producing hydrogen without affecting a **reforming catalyst** and **fuel cell** electrodes, and to provide a method for producing hydrogen for fuel cells by using the above fuel oil.
SOLUTION: The fuel oil for fuel cells comprises a hydrocarbon compound mixture which contains >=90 vol.% of a fraction 140-270°C in boiling point but substantially contains no aromatic compounds and has the molar ratio C/H of <=0.5. The method for producing hydrogen for fuel cells comprises vaporizing the above fuel oil and mixing it with **steam** followed by catalyzing the mixed gas with a reforming catalyst.
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IC ICM C10L001-04
ICS B01J023-46; C01B003-38; C10G045-02; C10G045-08; C10G045-44; C10G045-50; C10L001-16; C10L001-18; C10L001-22; H01M008-06

L39 ANSWER 6 OF 15 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 1999-144751 JAPIO

TITLE: DIRECT TYPE DIMETHYLETHER FUEL CELL, DIRECT TYPE LAYERED DIMETHYLETHER **FUEL CELL** SYSTEM, POWER **GENERATING** METHOD AND ELECTRODE **CATALYST** FOR THE **FUEL CELL**

INVENTOR: TSUTSUMI YASUYUKI; SATO JUNJI; ITO MASARU

PATENT ASSIGNEE(S): NE CHEMCAT CORP

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 11144751	A	19990528	Heisei	H01M008-10

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APPLICATION INFORMATION
     STN FORMAT:            JP 1997-323807         19971110
     ORIGINAL:              JP09323807             Heisei
PRIORITY APPLN. INFO.:      JP 1997-323807         19971110
SOURCE:                     PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined
                            Applications, Vol. 1999
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AN 1999-144751 JAPIO

AB PROBLEM TO BE SOLVED: To provide a direct type dimethylether fuel

cell, which can eliminate the complexity of a HC reformed fuel cell and problems in a method for storing, and loading fuel in a direct fuel cell and which does not generate toxicity and which can improve the power generating efficiency, and of which performance is higher than that of a conventional direct type methanol fuel cell.
SOLUTION: A direct type dimethylether fuel cell has a proton conductive electrolyte part, a pair of gas diffusing cathode 3 and anode 2 for pinching the electrolyte part, and each electrode is provided with a noble metal contained electrode catalyst layer at an electrolyte side thereof. A cathode side gas distributing plate 7 and an anode side gas distributing plate 6 are arranged in the catalyst layer of the gas diffusing electrode on the opposite side thereof, and dimethylether and **steam** are supplied to the anode and oxygen or air is supplied to the cathode so as to configure a fuel cell.

IC ICM H01M008-10
ICS H01M004-90; H01M004-92; H01M008-02; H01M008-06

L39 ANSWER 7 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 1992-149003 JAPIO
TITLE: TWO-STAGE **CATALYTIC** COMBUSTION TYPE **REFORMER** FOR **FUEL CELL**
INVENTOR: OKANO TETSURO; UEMATSU KENGO
PATENT ASSIGNEE(S): YOUYUU TANSANENGATA NENRYO DENCHI HATSUDEN SYST GIJUTSU KENKYU KUMIAI
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 04149003	A	19920522	Heisei	C01B003-38

APPLICATION INFORMATION
STN FORMAT: JP 1990-271701 19901009
ORIGINAL: JP02271701 Heisei
PRIORITY APPLN. INFO.: JP 1990-271701 19901009
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1992

AN 1992-149003 JAPIO
AB PURPOSE: To simplify the structure and to improve the miscibility and dispersibility of the second-stage fuel in the first-stage combustion gas current by closely and uniformly arranging the reaction tube and fuel feed pipe having the same diameter in a specified manner.
CONSTITUTION: The reaction tubes 3 are staggeringly arranged, the fuel feed pipes 15 having the same diameter as the reaction tube 3 are arranged around the reaction tubes 3 at the angular pitch of 60°, and the distance between the reaction tube 3 and the

adjacent pipe 15 is equalized to that between the immediate adjacent reaction tubes 3. A hydrocarbonic material such as liquefied natural gas is supplied from a nozzle 1 to the reaction tube 3 packed with a reforming catalyst bed 5. The waste gas from an attached fuel cell is simultaneously supplied from a nozzle 8 to a first- stage catalytic combustion part 10 and burned, and the combustion gas is sent downward to heat the reaction tube 3. The waste gas from the fuel cell is supplied from a nozzle 13, passed through the pipe 15, mixed with the first-stage combustion gas and burned in the second-stage combustion catalyst bed 17, the combustion gas is allowed to flow countercurrently with the hydrocarbon flowing in the reaction tube 3 to heat the hydrocarbon, and hydrogen is generated by the **steam** reforming reaction and supplied to the fuel cell.

IC ICM C01B003-38
ICS B01J008-06
ICA H01M008-06

L39 ANSWER 8 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 1991-167759 JAPIO
TITLE: CATALYST TEMPERATURE CONTROLLER OF FUEL REFORMER FOR USE IN FUEL CELL
INVENTOR: UMEMOTO MASATSURU
PATENT ASSIGNEE(S): FUJI ELECTRIC CO LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 03167759	A	19910719	Heisei	H01M008-04

APPLICATION INFORMATION
STN FORMAT: JP 1989-306018 19891125
ORIGINAL: JP01306018 Heisei
PRIORITY APPLN. INFO.: JP 1989-306018 19891125
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1991

AN 1991-167759 JAPIO

AB PURPOSE: To obtain a stably reformed gas by setting the aim of control of the inner wall surface temperature of the catalyst layer outlet portion of the reforming pipe to the temperature corresponding to the amount of load of a fuel cell, and controlling the flow of reformed material or that of auxiliary fuel and that of combustion air according to deviation of detected temperature from the aimed temperature.

CONSTITUTION: A thermocouple as a temperature detector 30 is mounted on the inner wall surface of the catalyst layer outlet portion of a reforming pipe 7 and a temperature setter 44 is provided to which a

load current is input from a current detector 31 serving as a load detector and which outputs signals indicative of the aim of the surface temperature of the catalyst layer outlet portion of the reforming pipe 7 in such a manner that the more the load current is increased the higher the aim of the surface temperature. As the amount of natural gas corresponding to that of load during power generation of a **fuel cell** 17 is **steam reformed** by the **catalyst** layer 6 of the reforming pipe 7 and supplied to the fuel cell 17, the temperature of the catalyst layer outlet portion of the reforming pipe 7 is controlled via the inner wall surface temperature of the reforming pipe 7 to the desired temperature corresponding to the amount of load output from the temperature setter 44 in such a manner that temperature changes like the excess of transition of the catalyst layer temperature during fluctuations in the load are reduced, and also that the response speed of control is heightened. A stably reformed gas is thus obtained.

IC ICM H01M008-04

L39 ANSWER 9 OF 15 JAPIO (C) 2004 JPO on STN

ACCESSION NUMBER: 1990-207843 JAPIO

TITLE: PRODUCTION OF **STEAM REFORMING CATALYST** AND HYDROGEN FOR **FUEL CELL**

INVENTOR: INOUE YUKIO

PATENT ASSIGNEE(S): SEKIYU SANGYO KATSUSEIKA CENTER
NIPPON MINING CO LTD

PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 02207843	A	19900817	Heisei	B01J023-84

APPLICATION INFORMATION

STN FORMAT: JP 1989-28613 19890209

ORIGINAL: JP01028613 Heisei

PRIORITY APPLN. INFO.: JP 1989-28613 19890209

SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1990

AN 1990-207843 JAPIO

AB PURPOSE: To obtain a **steam** reforming catalyst ensuring a low reaction pressure, forming a small amt. of carbon even in a low molar ratio of **steam** to carbon and requiring regeneration at a prolonged interval by incorporating 5-30wt.% Ni, 0.5-5wt.% Mn, 0.5-5wt.% Fe and 2-10wt.% Ba into an alumina carrier.

CONSTITUTION: In order to prevent the deterioration of hydrocarbon reforming performance and the reduction of the surface area of an

effective Ni catalyst, 5-30wt.% Ni is incorporated into an alumina carrier. In order to prevent the deterioration of carbon formation inhibiting performance and reforming performance, 0.5-5wt.% Mn and 0.5-5wt.% Fe are incorporated into the alumina carrier. In order to maintain high reforming activity and to enhance carbon formation inhibiting effect, 2-10wt.% Ba is incorporated into the alumina carrier. The resulting **steam** reforming catalyst ensures a low reaction pressure, forms a small amt. of carbon even in a low molar ratio of **steam** to carbon and requires regeneration at a prolonged interval.

IC ICM B01J023-84
ICS C01B003-40; C10G011-02; C10G011-20

L39 ANSWER 10 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 1990-056864 JAPIO
TITLE: FUEL CELL POWER GENERATING SYSTEM CAPABLE OF MONITORING STATE OF REFORMING CATALYST
INVENTOR: TAKE TETSUO
PATENT ASSIGNEE(S): NIPPON TELEGR & TELEPH CORP <NTT>
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 02056864	A	19900226	Heisei	H01M008-04

APPLICATION INFORMATION
STN FORMAT: JP 1988-207799 19880822
ORIGINAL: JP63207799 Showa
PRIORITY APPLN. INFO.: JP 1988-207799 19880822
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1990

AN 1990-056864 JAPIO

AB PURPOSE: To monitor the state of the **reforming catalyst** of a **fuel cell** power generating system by providing a hydrogen concentration monitoring device storing a hydrogen sensor.

CONSTITUTION: A hydrogen concentration monitoring device 22 storing a hydrogen sensor is provided between a reforming device 6 and a fuel cell main body 12 in a fuel cell power generating system constituted of the fuel cell main body 12 consisting of a fuel electrode 13, an electrolyte 14 and an oxidizer electrode 15, the reforming device 6 feeding the fossil fuel A, a fuel feeding system containing a shift converter 8, a **steam** separator 10 or the like, an air feeding system feeding the air J, a cooling system of the cooling water O, and an ancillary feeding device. The hydrogen concentration monitoring device 22 measures the hydrogen concentration in the reformed gas fed to the fuel electrode 13. When

a reforming catalyst is deteriorated, the reform reaction efficiency of the fossil fuel A is reduced, and the hydrogen concentration in the reformed gas is decreased. The state of the reforming catalyst can be monitored by measuring the hydrogen concentration in the reformed gas with the hydrogen concentration monitoring device 22.

IC ICM H01M008-04
ICS H01M008-06

L39 ANSWER 11 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 1990-002878 JAPIO
TITLE: **STEAM REFORMING CATALYST** FOR **FUEL CELL**
INVENTOR: MUSHIAI AKIRA; ISHIZAKI FUMIYA; SEGAWA TOMOKO
PATENT ASSIGNEE(S): TONEN CORP
SEKIYU SANGYO KATSUSEIKA CENTER
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 02002878	A	19900108	Heisei	B01J023-40

APPLICATION INFORMATION
STN FORMAT: JP 1988-220494 19880905
ORIGINAL: JP63220494 Showa
PRIORITY APPLN. INFO.: JP 1988-57371 19880312
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1990

AN 1990-002878 JAPIO

AB PURPOSE: To obtain a **steam** reforming catalyst having high activity, inhibiting the deposition of carbon and prolonging the service life by supporting Rh, Ru, Pd, Pt or an alloy thereof on a tetragonal or cubic zirconia carrier contg. yttria.
CONSTITUTION: Rh, Ru, Pd, Pt or an alloy thereof is supported on a tetragonal or cubic zirconia carrier contg. a small amt. of yttria to obtain a **steam reforming** catalyst. This **catalyst** is incorporated into a **fuel cell** and performs efficient **steam** reforming of hydrocarbons to produce fuel for the cell. Since the catalyst inhibits the deposition of carbon, the service life is prolonged.

IC ICM B01J023-40
ICS C10G011-02; H01M008-06

L39 ANSWER 12 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 1989-167958 JAPIO
TITLE: INTERNALLY REFORMING TYPE MOLTEN CARBONATE FUEL CELL

INVENTOR: YAMAMOTO YOHEI; TAKAHASHI HIROFUMI
PATENT ASSIGNEE(S): TOKYO GAS CO LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 01167958	A	19890703	Heisei	H01M008-02

APPLICATION INFORMATION
STN FORMAT: JP 1987-327997 19871223
ORIGINAL: JP62327997 Showa
PRIORITY APPLN. INFO.: JP 1987-327997 19871223
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1989

AN 1989-167958 JAPIO

AB PURPOSE: To lengthen the life of a cell by making a reforming catalyst face the oxidizing agent electrode of an adjacent unit fuel cell through a separator and arranging no oxidizing agent passage between the reforming catalyst and the oxidizing agent electrode.
CONSTITUTION: When fuel containing hydrocarbon and **steam** are supplied to a fuel passage 13, fuel reforming reaction arises by a reforming catalyst 14 to produce hydrogen, carbon monoxide, and carbon dioxide. The amount of heat necessary for reforming reaction is supplied to the reforming catalyst 14 from an oxidizing agent electrode 12, in which exothermic reaction arises, through an electrolyte matrix 16 and a fuel electrode 11, and at the same time from the oxidizing agent electrode 12 of an adjacent unit fuel cell. Since an oxidizing agent passage 15 does not exist between the reforming catalyst 14 and the oxidizing agent electrode 12 of the adjacent unit **fuel cell**, the **reforming catalyst** 14 locates in the nearest place to the oxidizing agent electrode 12 of the adjacent unit fuel cell, and heat is effectively transferred to the reforming catalyst 14 from the oxidizing agent electrode 12. The temperature drop of the reforming catalyst caused by endothermic reforming reaction is prevented and the condensation of electrolyte vapor on the reforming catalyst is retarded.

IC ICM H01M008-02
ICS H01M008-06

L39 ANSWER 13 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 1986-267272 JAPIO
TITLE: MOLTEN CARBONATE TYPE FUEL CELL
INVENTOR: YOSHIOKA SUSUMU; MURAKAMI TADATAKA; TAKEUCHI MASAHITO
PATENT ASSIGNEE(S): HITACHI LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 61267272	A	19861126	Showa	H01M008-06

APPLICATION INFORMATION
STN FORMAT: JP 1985-108204 19850522
ORIGINAL: JP60108204 Showa
PRIORITY APPLN. INFO.: JP 1985-108204 19850522
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1986

AN 1986-267272 JAPIO

AB PURPOSE: To reduce the pressure loss in a fuel gas passage, by using a honeycomb catalyst as a reforming catalyst packed in the fuel gas passage.

CONSTITUTION: A fuel gas passage 20 for feeding a fuel gas to a fuel electrode plate 11 by reforming a hydrocarbon gas 40 with **steam** 41 is defined by a separator plate 21 at the fuel electrode plate. A reforming honeycomb catalyst 22 is provided on a current collector plate 23 on the fuel electrode plate 11 at the fuel gas passage 20. A gas inlet port 24 for the hydrocarbon gas 40 and the **steam** 41 is provided in the separator plate 21 and connected to a gas inlet manifold 25. A gas outlet port 26 is provided in the separator plate 21 and connected to a gas outlet manifold 27. The hydrocarbon gas 40 and the **steam** 41 are fed to the fuel gas passage 20 through the gas inlet port 24 so that the hydrocarbon gas is reformed with the **steam** in the presence of the **reforming** honeycomb **catalyst** 22 at a **fuel cell** operation temperature of about 650°C.

IC ICM H01M008-06
ICS H01M008-04

L39 ANSWER 14 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 1986-193373 JAPIO
TITLE: INTERNALLY REFORMED TYPE FUEL CELL LAMINATE
INVENTOR: MATSUMURA MITSUIE; OKADA TATSUNORI; KOTOGAMI YOSHIHIDE
PATENT ASSIGNEE(S): MITSUBISHI ELECTRIC CORP
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 61193373	A	19860827	Showa	H01M008-06

APPLICATION INFORMATION
STN FORMAT: JP 1985-30608 19850220

ORIGINAL: JP60030608 Showa
PRIORITY APPLN. INFO.: JP 1985-30608 19850220
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1986
AN 1986-193373 JAPIO
AB PURPOSE: To aim at obtaining electric output stable over a long term, by making electrochemical characteristics of unit fuel cells at the entrance part of gas flow smaller than those at other parts, when laminating plural number of unit **fuel cells** in which **reforming catalysts** are arranged in a gas passage on the fuel gas side adjacent to an electrode on the same fuel gas side.
CONSTITUTION: At the fuel gas entrance part of a fuel gas side perforated plate 14 with a number of openings 14a, opening ratio is made smaller, while gas diffusion resistance being made bigger, than those at other parts, in order to make electrochemical characteristics of fuel cells at the entrance part smaller than those at other parts. Thus, in the fuel gas, consisting mainly of hydrocarbon or alcohol group and **steam**, to be supplied to laminate of internally reformed, molten carbonates type fuel cells, reaction consuming hydrogen takes place in parallel with gas decomposition etc at the gas side passage 8 adjacent to the gas side electrode 2 keeping current density of cells at the entrance part as small as it used to be, even when a large amount of electric current is taken out. Accordingly, the activity of reforming catalysts 10 is made stable and even a small amount of filling load comes to do well.

IC ICM H01M008-06
ICS H01M008-02

L39 ANSWER 15 OF 15 JAPIO (C) 2004 JPO on STN
ACCESSION NUMBER: 1986-024167 JAPIO
TITLE: INTERNAL REFORMATION TYPE, FUSED CARBONATE TYPE FUEL CELL
INVENTOR: MATSUMURA MITSUYA; URUSHIBATA HIROAKI
PATENT ASSIGNEE(S): MITSUBISHI ELECTRIC CORP
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 61024167	A	19860201	Showa	H01M008-06

APPLICATION INFORMATION
STN FORMAT: JP 1984-146315 19840713
ORIGINAL: JP59146315 Showa
PRIORITY APPLN. INFO.: JP 1984-146315 19840713
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined

Applications, Vol. 1986

AN 1986-024167 JAPIO

AB PURPOSE: To allow a **reforming catalyst** and a **fuel cell** to be effectively separated without increasing the diffusion resistance of the reaction gas by inserting an opened porous body between the **reforming catalyst** and the **fuel cell.**

CONSTITUTION: The fuel gas mainly consisting of hydrogen carbide and **steam** is fed to a groove 8a filled with a reforming catalyst 7 and a fuel gas passage constituted with an opened porous body 8, and it is reformed into the fuel gas mainly consisting of hydrogen and carbon monoxide via the action of the reforming catalyst 7. These hydrogen and carbon monoxide is diffused through the opening section of the opened porous body 8 and is uniformly fed to the whole surface of an oppositely-provided fuel cell 2 and is dissipated, thus generating electric energy and byproduct thermal energy. Accordingly, the reforming catalyst 7 is spacially separated from the fuel cell 2 via the opened porous body 8, thereby the activity deterioration due to the contact with the electrolyte can be prevented. Moreover, the fuel gas is not prevented from being diffused, thus the activity deterioration of the reforming catalyst 7 is prevented, and the stable cell characteristic can be obtained for a long time.

IC ICM H01M008-06

ICS H01M008-02

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